one tube of each make, with two exceptions, in which nine makers only were represented in each group. The method of grouping is illustrated in Fig. 1. The tubes were numbered consecutively 1 to 198, and the different makes were numbered 1 to 10.

The boiler fitted with the experimental set of tubes commenced work in October, 1898, and finished in December, 1901. During that time the engine ran 142,348 miles. In order to determine the relative merit of each make of tube the following rule was observed. When a tube failed, it was taken out of the boiler and the mileage of the engine was noted; and when a second tube of the same make failed, the whole of the tubes of that make were removed from the boiler and the engine-mileage up to the failure of the second tube was noted. While the experiment was in progress, the tubes were re-rolled and re-ferruled and the ferrules were knocked up several times.

The first tube failed after the engine had completed 34,067 miles, and the second tube of the same make at the end of 40,612 miles; whereas the first and only failure of the make which stood the best did not take place until the engine had completed 123,896 miles. Of the tubes second in order of merit, only one tube failed, and that at the end of 107,507 miles. When the engine had completed 142,348 miles, it was decided to stop the experiment, although the experimental tubes remaining in the boiler, by two makers, were still in fairly good condition.

It was observed that, with one exception the failure of the tubes was due to their having worn thin from the inside, invariably at the bottom and within 6 inches of the fire-box end of the tube, the pressure inside the boiler causing them to collapse. The one exception was that of a tube which cracked during re-rolling. It is singular that the inside of the tubes should invariably wear thin at the bottom. Doubtless, this unequal wasting of the tube is due either to the sulphurous acids from the sulphur in the coal condensing on the bottom of the tube near the fire-box end during the lighting-up of the boiler, and thus corroding the metal; or to a portion of the cinders striking the top, inside of the ferrule, and being deflected downwards against the bottom of the tube. A typical example showing the unequal wasting of the tube just beyond the ferrule is illustrated in Fig. 2, and the shape and thickness of a typical "burst" tube are shown in Fig. 3.

Chemical analyses of each of the tubes that failed, and of the average of the tubes that did not fail, were made. The results of the analyses, together with the mileage of each make of tube, arranged in order of mileage—and therefore of merit—and are shown diagrammatically in Fig. 4. There is practically no difference in the chemical composition of tubes of the same make, whether they failed or not; and that the two makes of tubes which stood the best are hardened with nickel and arsenic respectively. Of the tubes marked C in order of merit, two failed (Nos. 146 and 178) at the same time; hence, three tubes of this make are shown as having failed.

Taking the quantity of arsenic present as determining the hardness of the tube, and the hardness as representing its life, the tubes E should, at least, be one place higher in order of merit. However, the make which stood the best is quite different from the others in chemical composition. The most satisfactory copper tubes for locomotives are those containing either 3 per cent. of nickel, or at least 0.5 per cent. of arsenic. Copper tubes hardened with nickel are now being put into locomotives on the London & North Western, and good results are expected.

Three samples of seamless copper tubes, said to contain 3 per cent. of nickel, 0.5 per cent. of arsenic, respectively, which have been made as the outcome of the foregoing investigation, have been submitted to the

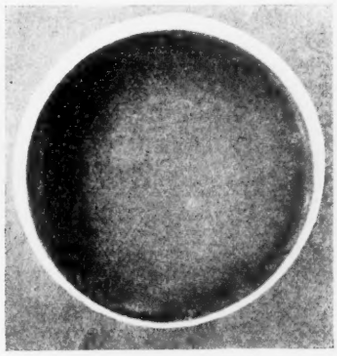


Fig. 2—Tube Showing Unequal Wasting.

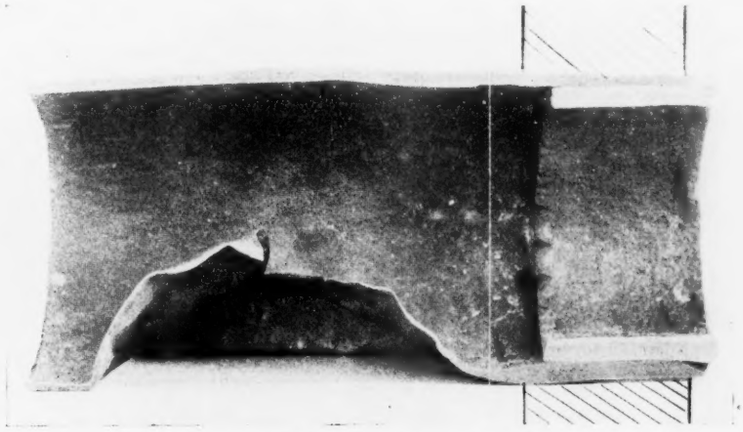
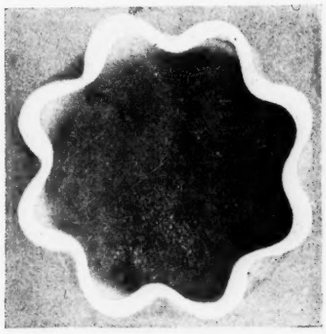


Fig. 3—A Typical "Burst" Tube.



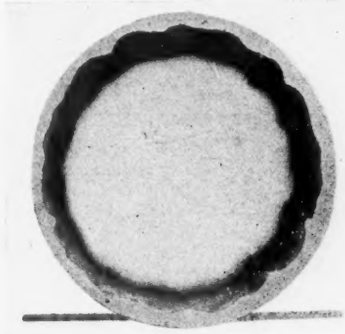


Fig. 6—Worn Ordinary Tube.

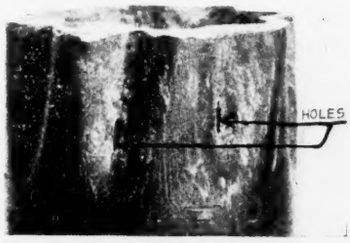



Fig. 5—Elevation and Section of Worn Fluted Tube.

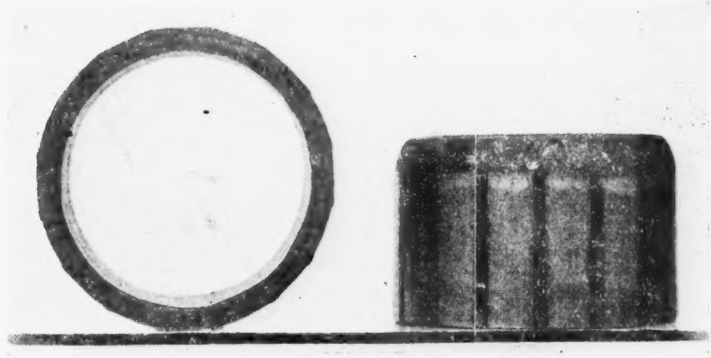


Fig. 7—End View and Elevation of Steel Ferrule.

author. Mechanical tests indicate that the tubes are softer than the average of 32 samples of ordinary copper tube taken from consignments received from time to time. Nevertheless, on cutting them with a chisel they do not show particularly soft metal.

Some time ago experiments were conducted at Crewe with fluted copper tubes, Fig. 5, but it was found that the ridges inside the tube suffered abrasion, especially at the commencement of the ridges, just beyond the ferrule, which were rather quickly worn through; consequently the use of such tubes had to be abandoned. An ordinary copper tube which has suffered abrasion rather severely, as will be seen from the corrugated appearance of the inside surface of the tube, is illustrated in cross-section in Fig. 6.

In conclusion, a form of steel ferrule, introduced by the author at Crewe some time ago, may be mentioned. The ferrules, which are stamped from mild-steel sheet, are, in the fourth of the five operations of manufacture, forced into a die which forms 16 small ridges, $^1/_{16}$ in. in width and about $^1/_{64}$ in. in depth on the outside. These ferrules, having a taper of 1 in 80, in addition to the ridges, are found to hold better in the ends of the tubes, which are rolled with parallel sides, than the plain turned ferrules with a taper of 1 in 40. An elevation and an end-view of this improved ferrule are shown in Fig. 7.

## The Tehuantepec Route.

BY E. L. CORTHELL.

After 384 years—Cortez to Diaz—with projects without number and failures many, and with persistent efforts on the part of Mexico; after the expenditure of large sums of money, the end is in sight, for the railroad across the Isthmus of Tehuantepec, from ocean to ocean, will be ballasted complete by the end of this year. There will be a depth of 22 ft. through the Coatzacoalcos bar in the Gulf at the end of 1905, with 33 ft. to follow. The Salina Cruz harbor on the Pacific will be protected by its two breakwaters in the sea and the inner port be ready for business, and at that time lines of steamships will be operating from both ports to the coastwise ports of Mexico and the United States and to other countries. The works from sea to sea are being prosecuted with all the energy possible by one of the most energetic and experienced contracting firms of the present day—Messrs. Pearson & Sons, of London—who are also the contractors for the four East River tunnels of the Pennsylvania Road between New York City and Long Island.

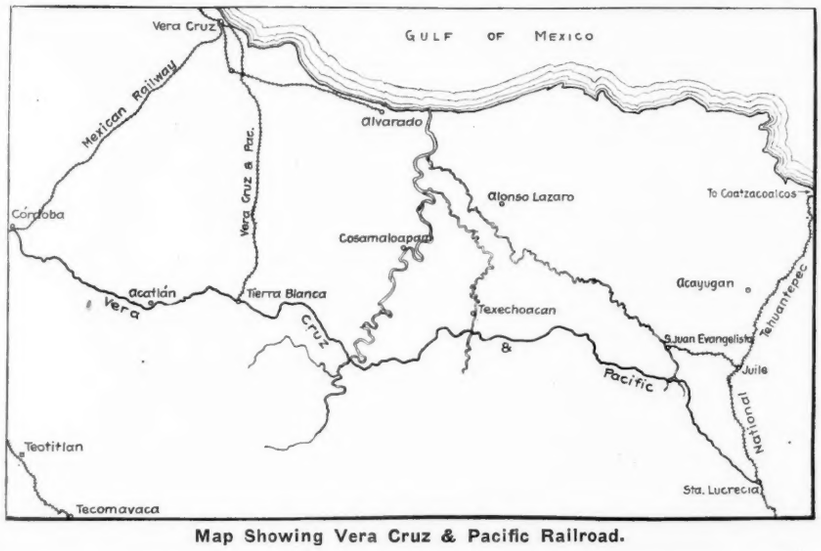
There are still—dating from November, 1903—over ten millions gold to expend on the two harbors and ports facilities. When the work is finally complete there will be open to the world's commerce a truly interoceanic route. The fact that the Mexican Government is a partner with Pearson & Sons in the construction and operation for 40 years of this route and that the Government by a "merger" with certain railroad companies now controls the operation of important systems extending from Laredo to Salina Cruz makes it important for the *Railroad Gazette* to briefly review the history of the project—dating back nearly 400 years, and to present advantages claimed for this route by President Diaz and his advisers. Their view, resolutely held, is that the Tehuantepec Route will be entirely completed and in full operation with its own lines of steamships eight years before the Panama Canal can possibly be opened to interoceanic traffic; that the Tehuantepec Route has immense geographic and navigation advantages over Panama and that it can easily draw to itself in the eight years all the traffic naturally tributary to it, and that, even after the opening of the Panama Canal, its excellent facilities for the prompt and economical handling of freight from ship to car and car to ship, will enable it to hold all it will have acquired; also that the ever-increasing volume of the world's commerce and of interoceanic traffic will enable the Tehuantepec Route to acquire its share of this increase, sufficient to make the great investments of the Government yield a fair return. It may be stated also that the Government of Mexico and its people have always believed it was their duty to the world to develop what they believe to be the natural and most advantageous route for the commerce of the world to pass between the oceans.

In 1520, as soon as Cortez, through the hospitality of Montezuma, was installed in the Aztec national palace, he inquired of the king if he had any charts of the coast. The king produced them and the eagle eye of Cortez at once lighted upon the mouth of the Coatzacoalcos river. Immediately a reconnoitering party was sent to explore it. The report was so favorable upon this landlocked harbor and the great river stretching many miles into the interior that Cortez urged upon the Emperor, Charles V. of Spain, to make this the route to Cathay. Cortez was so sure that it would be an interoceanic route some day that he asked for and received the grant of an immense tract of land in the interior of the isthmus and was made Marquis of the Valley of Oaxaca. The route of the railroad of the present day passes through the lands of his descendants. They are called the Marquesanas—or estates of the Marquis. They embrace about 200,000 acres.

There is evidence that Cortez built a military road from the city of Tehuantepec on the Pacific to the headwaters of the Coatzacoalcos on the Atlantic, and that it was in use for a hundred years. A century later the Spanish viceroy was petitioned to declare Coatzacoalcos a port of entry and a great depot of commerce instead of the port and city of Vera Cruz.

The first real survey was made in 1774 by a civil engineer named Augustin Cramer by order of the Viceroy. He reported that, "It would not be a work of great difficulty, nor excessively costly to effect a communication between the two seas across this isthmus." In 1814 another project for a canal was brought forward and the Spanish Cortes authorized the opening of "a canal across the Isthmus of Tehuantepec in preference to Nicaragua and Panama." In 1824 a survey was made by Col. Orbegozo, appointed by the General Government. This was three years after Mexico became an independent republic. In 1842 President Santa Anna granted a citizen of Mexico, José de Garay, the right of way across the isthmus for a communication between the Atlantic and Pacific. This was about the time of the advent of railroads, and the grantee had the privilege of building a canal or to use "railroads and steam carriages." The survey for the route was made soon afterward by Gaetano Moro.

This concession was extended several times, and in 1848 Garay transferred his concession to an English company, and they in 1849 assigned it to Mr. Hargous, of New York. The Tehuantepec Railroad Company, of New Orleans, organized under the Garay concession, assigned to Hargous and began an exhaustive survey for a railroad in 1850, under the charge of Gen. J. G. Barnard, Topographical Engineer, assisted by Mr. J. J. Williams, C. E. Mr. Williams arranged and prepared the results of the survey in a published work of about 300 pages and a book of maps. This work gave a "résumé of the geology, climate, local geography, productive industry, fauna and flora of that region." This very interesting work has formed the basis of all later studies. It was published in 1852. However, before work could be undertaken the Mexican Congress, in 1851, declared the concession granted in 1842 and amended in 1846 null and void on the ground that the acting-president had exceeded his powers.




Map Showing Vera Cruz & Pacific Railroad.

During all the intervening five years there had been not only distrust of the people and Government of the United States, but for two years a war, leaving a fear of the overshadowing influence of the greater republic. They did not wish to have at Tehuantepec a repetition of what had just happened in Texas. This distrust was strengthened by some filibustering invasions of the border States of Mexico.

The distrust and the failure to conclude a treaty of neutrality over the Isthmus of Tehuantepec, which the United States Government would have been glad to celebrate, and the evident determination of the Mexican Government not to recognize the charter to Garay, which had come into the hands of United States citizens, led parties in the

latter country interested in Isthmus transit to apply to the Government of Granada for a concession. This was granted with a treaty between the two governments to build a railroad across the Isthmus of Panama, which was begun in 1850 and finished in 1855.

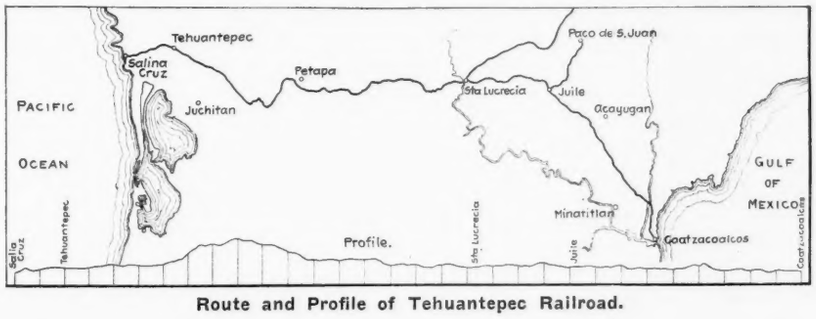
Had it not been for these conditions, no doubt the railroad would have been built at Tehuantepec at that time and none would have been built at Panama and no canal would have been built there; and Tehuantepec would now be the world's highway of commerce between the oceans, either by a railroad, as now; or by a canal, which Capt. Shufeldt declared entirely practicable after extended surveys, or by a ship railroad, as proposed by Capt. Eads.

After annulling the Garay grant the Mexican Congress in 1812 arranged for propositions on an international competition to open a route across the Isthmus. A company composed of Mexican and American citizens obtained the contract. Mr. A. G. Sloo was the moving spirit in this project, but nothing came of it, and it was annulled in 1857. In the same year a grant was made to the Louisiana Tehuantepec Company. This was twice extended, until in 1861 Napoleon III. instructed his minister in Mexico to secure the grant which this company had just forfeited, and this stood on the records until October 12, 1866, when Emperor Maximilian extended the time, but three days later—October 15—President Juarez, not recognizing the authority of Maximilian, granted the right of way for a railroad and telegraph line to the "Tehuantepec Transit Company" and annulled the charter of 1857.

The headquarters of this last mentioned company was in New York City, but this charter also was later forfeited. In 1867 the President of Mexico gave a grant to Emilio de la Sere, an American citizen. A company was organized in Vermont by Act of the General Assembly of that State. Some amendments by the Mexican Government followed and in 1870 an additional right was granted this company to build a canal also. One of the earnest and indefatigable workers in this project was Simon Stevens, well known in New York as a persistent promoter of this project. He was President of the company. He published a book of 90 pages with maps and illustrations on the subject of Tehuantepec.

About this time the United States Government sent a party to the Isthmus in command of Capt. Shufeldt "to ascertain the practicability of a ship canal between the Atlantic and Pacific Oceans." The results were given in a quarto sized book with numerous illustrations and mape, 190 pages of text and 20 maps and profiles. The principal Civil Engineering assistant to Capt. Shufeldt was the late Prof. E. A. Fuertes, Dean of Engineering of Cornell University. The physical and hydraulic conditions were found to be favorable for the construction and operation of a canal 22 ft. deep—about the depth contemplated by the plans of the Government at Nicaragua at that date—60 ft. wide at bottom and 162 ft. at the top. The total length was to have been 144 miles and there were to have been 140 locks, all of very low lift, compared with modern lifts. The harbor conditions were reported to be very favorable on both sides of the Isthmus. As bearing on the entire subject of transit across the American Isthmus, the report of Admiral Shufeldt gives important testimony, and may be quoted here with advantage to the appreciation of the subject:

"I have, therefore, regarded canal communication through this hemisphere as American and local in its main object, incidental only as to the rest of the world. Viewed from this standpoint, a single glance at the map demonstrates not only the necessity of a canal, but its location. Each isthmus rises into importance as it lies nearer to the center of American political and commercial influence, and the intrinsic value of this eminently national work ought to be based upon the inverse ratio of the distance from that center. A canal through the Isthmus of Tehuantepec is an extension of the Mississippi River to the Pacific Ocean. It converts the Gulf of Mexico into an American lake. In time of war it closes that Gulf to all enemies. It is the only route which our Government can control. So to speak, it renders our own territory circumnavigable. It brings New Orleans 1,400 nautical miles nearer to San Francisco than a canal via Darien."




**Route and Profile of Tehuantepec Railroad.**

After several extensions and many failures to raise the money, the grant to La Sere finally was forfeited by act of the Government on May 31, 1879. In the meantime Mr. Edward Learned, of New York City, obtained a concession in 1879 with a subsidy of $7,500 per kilometer. This grant was terminated in 1882 for failure to complete the road in the time specified in the contract, only 35 kilometers having been finished. The Government settled with the company, taking over all its property on the Isthmus and paying $125,000 in Mexican silver dollars and $1,500,000 in United States gold. From this time on the Government itself undertook to build the road.

First it appointed a representative who was really an agent to buy the material and do the work on account of the Government. A contract was then made with this agent—Mr. Belfin Sanchez, a Mexican citizen—with a subsidy of $25,000 per kilometer of road built, but the work did not progress well and the contract was abrogated on April 25, 1888. Most of the work under this contract was on the Pacific side, that under the Learned contract being on the Atlantic side. The Government paid $562,910 as the value of the work done and material furnished, and $170,225 as representing the contractor's profits.

The President had been previously authorized by Congress to build the road, and under this authorization the Government issued 5 per cent. gold bonds, the total issue being $13,500,000, which were sold to a German syndicate of banks at 70 per cent. of their face value. A contract was signed with Edward McMurdo, of London, to build the road. He, however, died before he could enter actively upon the work. In 1892 the contract was abrogated, with about $2,000,000 silver remaining from the proceeds of the issue of bonds.

The Government made a contract on February 27, 1892, with Messrs. Stanhope, Hampson and Corthell to spend this amount in an attempt to unite the rails. The amount was not sufficient and Mr. Stanhope himself afterward arranged for enough to accomplish this out of a special Government loan, and he expended on the work $1,111,035. In 1898 the Government entered into a partnership contract with T. Pearson & Sons, of London. This was amended in 1902. This partnership, or "sociedad" was given the name of the "National Railroad Company of Tehuantepec." The contractors are the administrators or managers of the company's affairs.

The working capital is $5,000,000. The profits and losses of the operation are to be divided between the partners. The contract will terminate in 1953 and it contemplates the construction of the harbors and ports on both oceans, the installation of port and terminal facilities and the entire rehabilitation of the railroad, cutting down steep grades, taking out objectionable curves, ballasting the road complete from end to end, establishing yards and sidings and equipping the road with sufficient rolling stock for a large interoceanic traffic. Special attention is being given to the terminals—a deep channel entrance to the natural protected harbor at the mouth of the Coatzacoalcos river and a protected harbor with an interior port at Salina Cruz on the Pacific. Those ports will be provided with the most modern appliances for handling cargo with the greatest possible despatch and economy. There will be 10 meters (32.8 ft.) of water at both terminals with wharves and docks sufficient for the largest ocean vessels.

By the courtesy of Sir Weetman D. Pearson and the Hon. Leandro Fernandez, Minister of Communications and Public Works of Mexico, we are enabled to present the plans of the works, including the map of the route and a map of its connections with the Mexican and Interoceanic railroads, and also the plans of the harbor, ports and terminal facilities. As will be seen by the topographic map, the ascent from the Gulf of Mexico is gradual, over slowly rising land, to the table land, where the summit is about 924 ft. above sea level. The descent to the Pacific plains is much more abrupt. The plains on the Atlantic slope are, however, undulating and are traversed by many lateral streams of considerable size, tributary to the Coatzacoalcos, which is the main drainage of an extensive country subject to an annual rainfall of about 100 inches. The irregularities required in the preliminary construction an undulating grade and considerable sharp curvature. The heavier grades were from 1½ to 2 per cent. and the maximum curvature about 9 degrees about 600 ft. radius. The work of the present contract consists largely in cutting down unnecessary grades and in improving the alinement. The whole length of the route is 290 kilometers (180 miles). The gage is the standard of the United States—4 ft., 8½ inches.

The rail originally laid was 56 lbs. per yard. That required by the present contract is 80 lbs. The original rail is all being renewed. The bridges were mostly

wooden trestles and pile bridges, except over large rivers. Permanent structures, masonry or steel, are now being substituted for them. The entire line is being ballasted, sidings are being lengthened, yards laid down and the whole route put into shape for a heavy interoceanic traffic, and the rolling stock is being supplied to meet the requirement.

About 126 kilometers (78 miles) from the port of Coatzacoalcos the Vera Cruz & Pacific Railroad joins the Tehuantepec Railroad, at the station Sta. Lucretia. This is the terminus of the former line, as shown by the accompanying map. By the courtesy of the Minister of Communications we are able to show this Vera Cruz line and the other lines centering at Vera Cruz as well as the line to Cordoba on the Mexican Railway.

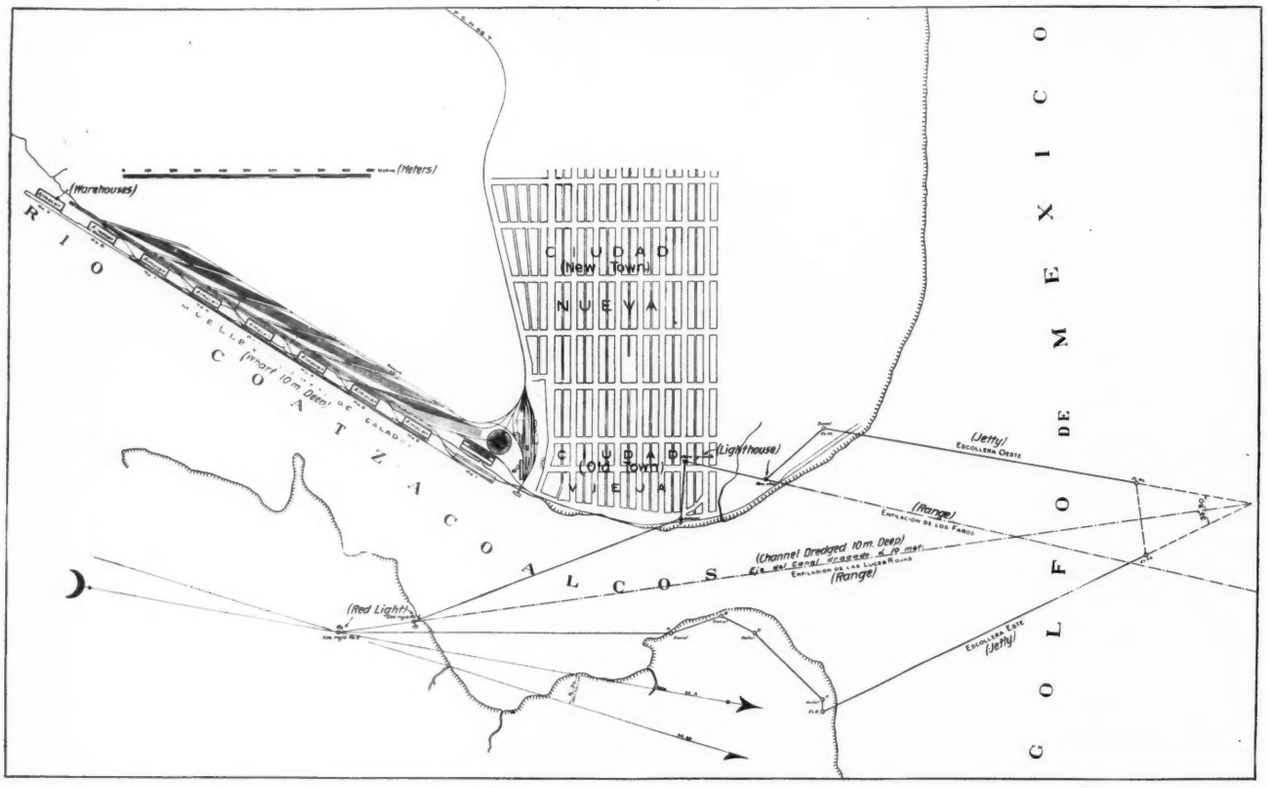
It is not probable that the line of Vera Cruz will have much of the Isthmian traffic, for the reason that from Salina Cruz on the Pacific to Vera Cruz the route is 200 kilometers (124 miles) longer than from Salina Cruz to Coatzacoalcos. There is, however, likely to be an important passenger traffic and Mexican freight traffic, via Vera Cruz, due to the fact that the Mexican Government has recently entered the railroad arena by arranging the "merger," previously referred to, of several systems in which it has lately obtained a controlling interest by purchase of a majority of stock. By those negotiations the Government has a majority ownership in an extensive system, reaching from the United States border to Salina Cruz, via the Mexican National to the City of Mexico; the Interoceanic, from the City of Mexico to Vera Cruz; the Vera Cruz & Pacific from Vera Cruz to Sta. Lucretia; and by its absolute ownership of the National Railroad of Tehuantepec from Sta. Lucretia to Salina Cruz. This is a long link in the proposed Intercontinental system from New York to Buenos Aires. The fact that there is rail connection from the United States to the Tehuantepec Railroad is an important advantage to that railroad as an interoceanic route.

It is important in outlining the conditions of the Tehuantepec Isthmus route to know what has been planned, what has been done and what is yet to be done at the two terminals, for the value and real importance of this route as an interoceanic factor will depend upon the character of the terminal facilities.

At Coatzacoalcos the Government by a contract with Pearsons made a dredged channel through the sea bar at the mouth of the Coatzacoalcos river between the extensive deep basin inside and the deep water outside. The bar in its normal condition had about 14 ft. of water on its crest. The channel was deepened to 32.8 ft. and 328 ft. wide. A rise in the river, bringing down the usual amount of silt and debris shoaled the channel in 14 days to 14 ft. The plan then decided upon and now being carried out as rapidly as possible is to build two permanent, substantial jetties of stone and concrete blocks on the location shown on the plan.

As will be seen, those dikes converge from a width of about 3,445 ft. at the shores to 919 ft. at the sea ends, about 3,280 ft. from the western shore. The plan contemplates a permanent channel through the bar 656 ft. wide and 32.8 ft. deep at low tide. If the works do not produce and maintain this channel no doubt dredging will be resorted to to accomplish it. At this writing somewhat over one-third the length from shore of the west jetty has been built; no work has been undertaken on the east jetty as yet. The plan also shows the extensive and well designed railroad terminal at the port. A natural depth of over 30 ft. is within 100 ft. of the shore line for a distance of over a mile. The wharf frontage planned extends over a mile and a quarter, with nine warehouses about 400 ft. long each, back of which is a railroad yard sufficient to handle the large number of cars required for an important traffic between rail and water. Four of the nine warehouses and the wharf in front are completed.

At Salina Cruz the conditions are entirely different. The waves of the Pacific beat upon the shore. There is no river to offer its basin for a harbon; only a long, curved shore line, with a promontory of porphyry rock 250 ft. high on the west, jutting boldly into the sea. This became naturally the base to which to tie a breakwater made out of the rock of the bluff. The stone blasted off became the foundation of a massive work formed of huge concrete blocks put in place by a powerful titan, which moves on the completed work. This dike is completed to within 100 meters (328 feet) of the sea end. The water deepens very rapidly, so that the dike will rest at the end in about 18 meters (59 feet) of water.




**Port of Coatzacoalcos, Eastern Terminus of Tehuantepec Railroad.**

The east dike is built in the same manner and the two when completed leave an entrance about 656 ft. wide. The east jetty is built by carrying the materials along the shore from the promontory and depositing them by a second titan that operates on this work. About one-third the distance from the shore has been completed at this date. The plan clearly shows the details of the port itself. The ground where it is located is a low, flat marsh, which can be easily dredged. Across the rear of the protected area extends a line of wharfing with an opening for the passage of vessels into the interior basin. On this wharfing are six warehouses with railroad tracks on each side for handling goods between rail and ship. Back of an extensive interior basin is a row of piers and slips, which are to be built as the traffic requires it. This basin has a depth of 32.8 ft. and there is none less anywhere in the outer port in front

of the warehouses. It will be seen by a glance at this plan that an important business is expected.

The costs of the harbor, port and terminal facilities, not including the railroad tracks, yards, etc., are as follows:

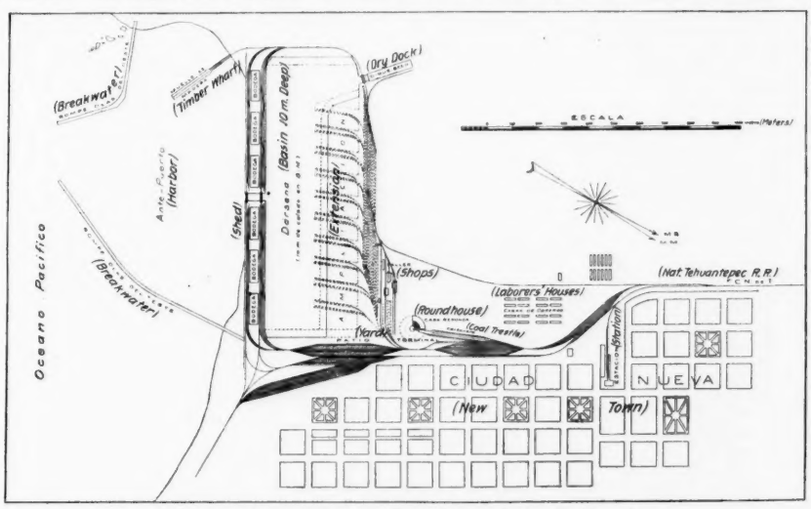
| | |
|---|---|
| Coatzacoalcos.. | |
| Total estimated approximate cost.... | $8,959,786 |
| Completed to November, 1903 ..... | 3,928,579 |
| Remain. to be done. | $5,031,207 |
| Salina Cruz..... | |
| Total cost.....$24,983,615 | |
| Completed to November, 1905..... | 8,602,570 |
| Remain. to be done. | $16,381,045 |

These amounts are all in Mexican silver, the present rate of exchange being about 42 cents. As near as we can estimate the total amount in gold dollars which the Mexican Government will have expended, including interest paid out, from the beginning of its efforts to build the railroad under the Learned contract to the entire completion of the route ready for interoceanic traffic will be about $33,000,000.

As stated by Admiral Shufeldt, the fact that Tehuantepec is nearer the "Axial line" of commerce of the world—Hongkong, Yokohama, San Francisco, New York, Liverpool—gives this route great advantages over Panama. An inspection of a globe will show that the shortest ocean route from Panama to the East—Yokohama and Hongkong—must pass along our coast to at least off San Francisco. In fact, the shortest line—the great circle—drawn between Panama and Yokohama passes through the Gulf of Mexico at Corpus Christi, more than one hundred miles east of San Francisco and through the Aleutian Islands. We may assume that the average saving in distance by the Tehuantepec Route over Panama to all points on our Atlantic coast and Europe is about 1,250 miles. The ordinary freight steamer makes about 10 miles an hour, or, say, 250 miles per day, requiring five days longer via Panama, assuming the time of crossing the two isthmuses to be the same. It will take a steamer about one day to pass through the Panama Canal and the freight about two days to pass over Tehuantepec from ship to ship, leaving still four days to the advantage of Tehuantepec.

It is assumed that at Tehuantepec the methods of handling cargo are the best and the quickest now employed anywhere. If the steamers built for this route are designed like the Morgan line steamers running to New Orleans and Galveston from New York, they will be able to discharge or load 5,000 tons of freight on board cars or on board ship in 10 hours. This is done regularly at Algiers, opposite New Orleans. Each of the three under decks for freight has great side ports hermetically sealed on the voyage, but opened up as the steamer lightens up in discharging. These ports are high enough so that a gang of men can truck the freight out of the ship into the cars, which have their floors at the level of the wharf floor. When the upper deck has been unloaded, the ship lightens up out of the water sufficiently to allow the next set of side ports to be swung open, and so on to the third. Heavy freight—machinery, etc.—which cannot be readily trucked out is stored near the hatchways and lifted out by the ship's tackle and loaded on flat cars, which stand on a track immediately under the ship's side. The steamers are loaded from the cars in the same manner and in the same time. Ten hours will suffice to transfer a cargo of 5,000 tons from the steamer to a train of cars and start it on its journey over the Isthmus.

As to grain, instead of the long voyage of 16,552 miles around Cape Horn from San Francisco to Liverpool, the sailing ships that carry it could run into Tehuantepec, transfer their cargoes by the method above described, if the grain is in bags, as is usual on this route, or by elevators at the two terminals, if in bulk, and save 8,250 miles, really 12,000 miles, for actual *sailing* distance is generally 50 per cent. greater than *steaming* distance.




**Salina Cruz, Western Terminus of the Railroad.**

This brings up another important matter which should not be lost sight of, viz.: the nautical advantages of Tehuantepec. It is safe to say that sailing vessels will never use the Panama Canal. They cannot reach it or get away from it. They always avoid the region of calms that prevail on both oceans opposite Panama. The opinion of Lieut. Maury still holds good. He summed up the nautical advantages as follows:

"Should nature by one of her convulsions rend the American Continent in twain and make a channel across the Isthmus of Panama or Darien as deep, as wide and as free as the straits of Dover, it would never become a thoroughfare for sailing vessels, saving the outward bound or those that could reach it by leading winds."

It is a mistake to assume that the sailing vessel is passing and soon to give way entirely to steamers. The sailing fleet of the world, while diminished in numbers, is still an important factor in ocean commerce, and as to the coastwise commerce of this country, it is still more important. Probably the coastwise tonnage in sail is twice that of steam, even figuring the steam ton as four times the sail ton. As to the relative cost of transportation over the two routes, this will depend in part upon the tolls and rates in each case, but as both routes are operated by governments we may assume that there will be competition and the rates scaled to secure all the business possible.

The extra cost of the four days to a steamer, say, $2,000, plus the canal tolls, would make a 5,000-ton cargo cost about $10,000 via Panama. No doubt the cost by Tehuantepec would be no greater and there would still be the saving in time of four days, which, to quick freight, is of great importance in this age of rapid transportation. Many estimates have been made of the tonnage to be expected over a trans-isthmian route. Some of these have been carefully worked out on a correct basis and some have been guessed at. Assuming 6,000,000 tons, which is about an average of the estimates, there is no doubt that, during the eight years when the completed and equipped Tehuantepec Route will be in operation before the Panama Canal will be ready to receive traffic, this route will draw to itself at least one-half of the tributary tonnage, and it is reasonable to expect that even after the Canal has opened it will hold all the tonnage acquired which is tributary to this route.

## Bending Moments in Rails.*

Wheel effects of moving locomotives are resolved into negative and positive bending moments by the rail when depressed from its unloaded position in the trackman's surface to its loaded condition in the "general depression." From a continuous beam resting on numerous cross-ties, as flexible supports in the ballast, and the latter upon a compressible subgrade, the rail, by the progressive loading, is converted into a "constrained beam," strengthened and stiffened to carry and distribute the driving wheel loads and the tractive effort. The cross-ties are flexible supports depressed more directly under the wheels than in the wheel spacing, and do not control the span of the bending rail, as generally supposed.

The wheel spacing and the wheel loads, loading the rails at intervals of two or three cross-ties, become the more important factors in fixing the span of the bending rails. When the rail is well spliced and stiff, it may be strengthened and stiffened by parts of the load of the locomotive for carrying and distributing the loads, etc. This favorable action of the rail as a beam loaded in the "general depression" (unique in mechanics) is in part due to the flexible supports upon which it is depressed by the several wheels of the subdivided total load, each wheel load causing conjoint strains in the metal of the section, which assists to check deflections under adjacent wheels. The foundation is also favorably loaded and restricted in its movements.

A single pair of wheels in a long wheel-spacing, independent of the conjoint action of other wheels on the rail, has a limited "general depression" confined to one specific deflection under the wheel. The looseness of the track not being reduced by preceding wheels, the positive bending moment is constrained only by the superstructure, instead of adjacent wheel loads.

In some stremmatograph† tests the total static load of the locomotive was 220,000 lbs., drawing a train of four cars, total weight of 430,000 lbs. In another test the total static load of the locomotive was 282,900 lbs., draw-

*Extract from a paper by P. H. Dudley read at the Atlantic City meeting of the American Society for Testing Materials, June, 1904.

†The stremmatograph is an instrument devised by Dr. Dudley for measuring the deflections of rails under moving loads.

ing a train of nine cars, weighing 910,000 lbs.—over twice as heavy, yet with its closer wheel spacing of the engine, the inch-pounds of the positive bending moments were less per pound of static load and were constrained by more efficient bending moments than for the lighter locomotive. In other words, the foundation or subgrade was more favorably loaded by the 10-wheel type of engine. These tests confirm the American theory and practice of the importance of distributing the wheel loads by well-designed wheel bases.

For the 10-wheel engine the positive bending moment for the wheels in good condition was 9.82 inch-pounds per pound of static load. Under a Consolidation type of locomotive drawing freight trains, even more favorable results are obtained. With the 12-wheel type of freight engines the results are still more favorable as to the distributed load through the rail section in loading the foundation. Details of the tests show the negative bending moments occur in the wheel spacing, and constrain the positive bending moments, which are nearly or directly under the wheels. At the points of flexure in the rail, shearing strains in the web connect the negative and positive bending moments between and under the wheels, making the action of the metal of the rail continuous in the "general depression" for the entire wheel base of the locomotive and under the first truck of the passenger coaches.

In freight service, with 60,000, 80,000 or 100,000 lbs. capacity cars, with an inside wheel spacing of 18 to 20 ft. only, the "general depression" is continuous for the entire train length.

The magnitude of the constraining negative bending moments in the wheel spacing for a given unit fiber strain, under the positive moments, depends upon the stiffness of the rail section, and looseness of the track, the latter being one of the variables in the permanent way. A closer comparison is more easily made between the unit fiber strains of the negative than of the positive bending moments.

In 4½-in. 65-lb. rails under switching engine No. 1 at the Grand Central Station, New York, having 125,000 lbs. upon three pairs of drivers, the unit fiber strains for the negative moments ranged from 1,800 to 2,500 lbs. for the unit fiber strains of 30,000 to 45,000 lbs. On the 6-in. 100-lb. rails, for similar unit fiber strains for the negative moments, the positive bending moments only had unit fiber strains varying from 6,000 to 8,000 lbs., the ratio of constraint being many times greater.

Limber rails have large unit fiber strains, but carry only small negative bending moments, and are also limited in the positive bending moments which they can sustain without exceeding the elastic limits of the metal. As the stiffness of the rail increases, with no greater unit fiber strains, larger bending moments are carried by the rails in distributing the wheel loads to the cross-ties, ballast and subgrade.

While it is easy by the construction of the wheel base of the locomotive to distribute a large total load on a stiff rail, the intensity of the pressure between the wheel contacts and the head of the rail is increased by the heavy axle loads, and the metal in our present rails under the rolling wheel contacts has much more work to do than was the case with the lighter wheel loads and more limber rail sections. The same physical properties which would sustain the light wheel loads for a large tonnage show a much greater rate of wear under the present wheel loads. The increased work of the stiffer rails and doubled wheel loads, with greater expended tractive power of the engines, should receive the attention and consideration it deserves, for our present service.

## Screw-Spikes and Dowels.*

The Bureau of Forestry has lately tested the pulling strength of spikes at its timber-testing station at Purdue University. A special holder was constructed, contrived to grip the heads of the spikes in a manner like the action of the rail, and to pull them from the tie in the direction of their length. The load at which the spikes pulled out from the ties was measured in pounds. Common spikes were driven into actual ties by an experienced track foreman to a depth of 5 in. and then pulled out by a testing machine. The screw-spikes were screwed into the same by hand, after a hole had been bored in the wood of a diameter equal to the diameter of the screw-spike at the root of the thread, namely, five-eighths of an inch. The load at which the screw-spikes pulled out was also measured on the testing machine.

The common spikes were 5½ in. long, 9/16 x 9/16 in. cross section, and weighed 170 to the hundred pounds. The screw-spikes were machined spikes, 5½ in. long, with a diameter at root of thread of five-eighths inch. The size of the thread was ⅛ x 7/32 in. and the pitch of the thread 2 in.; 85 spikes to the 100 lbs. The average force in pounds required to pull from the several ties the screw-spikes and common spikes was found to be as indicated in the following table:

| Kind of wood. | Force required to pull spike. Screw-spike. Pounds. | Common spike. Pounds. | Ratio of resistance of screw-spike to common spike. |
|---|---|---|---|
| Chestnut | 9,418 | 2,980 | 3.10 |
| Oak | 11,240 | 4,342 | 2.50 |
| Longleaf pine | 10,558 | 2,296 | 4.63 |
| White oak | 13,026 | 6,950 | 1.87 |
| Loblolly pine | 8,504 | 3,474 | 2.45 |

Other tests made to determine the relation of the pulling strength of common spikes to the depth inserted in the wood showed that the pulling strength varied directly as the depth of insertion into the tie.

In order to determine what is the effect of a side blow such as comes on a spike from the rail in service, and what tends to spread the track, a short piece of 50-lb. rail was spiked to a shortleaf pine tie by two spikes on opposite sides of the flange. The rail was then turned sidewise so as to receive on the inside the blow of a falling weight, and a 500-lb. weight was dropped against the side of the rail head, thus tending to jerk the inside spike from the tie and produce a side pressure on the outside spike. A drop of 3 in. produced the following effects on the common spike:

*Test No. 1.*—First blow pulled inside spike 1 in.; second blow pulled inside spike far enough for the rail to drop out.

*Test No. 2.*—First blow pulled inside spike ¼ in., second blow pulled inside spike far enough for the rail to drop out.

*Test No. 3.*—First blow pulled inside spike ½ in., second blow pulled the inside spike out far enough for the rail to drop out.

The same 500-lb. weight was dropped 3 in. on the head of a rail secured to the tie by two screw-spikes in the manner related above. Seven blows of the hammer did not start the inside screw-spike perceptibly, but gradually bent the head of the screw-spike over until the rail came out. The inside spike was slightly bent after the test.

Similar drop tests were made to determine the effect of a blow similarly delivered on the pulling strength of the spikes. One blow of the hammer from 3 in. high delivered to the side of the rail head fastened with two common spikes pulled the inside spike out about ½ in. The rail head was then removed, and the pulling resistance of the spikes was determined in the testing machine. The inside spike, which had been started ½ in., pulled out at 3,250 lbs., and the outside spike at 4,870 lbs.

Three blows of the hammer from 3 in. high were delivered to the rail head fastened with screw-spikes. The resistance of the latter against pulling out was then 8,930 lbs. for the inside spike, and 10,300 lbs. for the outside.

As the pulling strength of the common spike when not subjected to side blows was 4,380 lbs., and that of the screw-spike was 9,360 lbs., it appears that the pulling strength of the inside spike was diminished in each case, and that of the outside spike was increased. The latter effect was due to the bending of the spike. The effect of a great number of blows would undoubtedly be to diminish the pulling strength of the common spike because of the gradual destruction of the ends of the fibers of the wood in the hole.

The above results show that under the action of a side blow, such as comes on a rail, a common spike is pulled out from a fourth to a half inch, while the screw-spike is not perceptibly started.

### APPLICATION OF THE SCREW-SPIKE.

The screw-spike is now used on practically all of the Continental European railroads in one form or another, either exclusively or in connection with bolts or ordinary spikes. The manner in which the screws are put into position differs only in unimportant details in various countries, and it will be sufficient to describe their man-

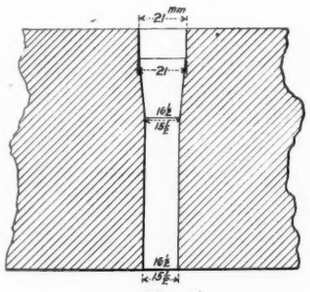



Fig. 1.

Shape of Hole bored in the tie for the Insertion of Screw-Spikes; French Eastern Railway.

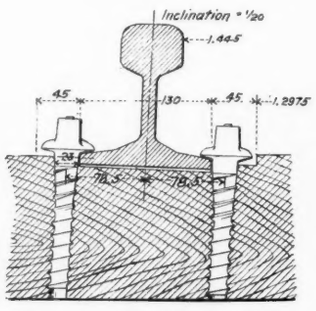



Fig. 2.

Section of Rail and Tie on the French Eastern Railway.

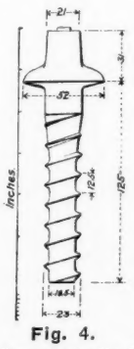



Fig. 4.

Screw Spike Used on the French Eastern Railway.

*Extract from Bulletin No. 50, U. S. Dept. of Agriculture, Bureau of Foresters, by Hermann von Schrenk.

ner of application for one. For this purpose the Eastern Railway of France is chosen as exemplifying a high type of work. The new ties are run through a machine at the treating plant before treatment. This machine adzes and bores holes in the tie. The upper part of the hole is wider, to admit the upper portion of the screw-spike. The ties are then treated with creosote and shipped out upon the line. When a tie is ready to be laid, the screw-spike is dipped in tar oil (of which each section crew has a bucket on its car) or tar oil is poured into the hole, and it is placed in the hole, the larger opening at the top of this hole allowing the screw to drop into it so as to stand practically vertical. The key is then applied and the screw is turned in by two men. Great care is taken in making the final turn of the screw not to turn it too far, which would destroy the thread made in the wood. When it becomes necessary to unscrew any of the spikes, either for the purpose of moving the tie along to secure its proper spacing after several years' service or for the purpose of inserting a tie-plate, one or two turns are made so as to allow the rail to spring up, and when the tie has been moved, or the plate inserted, the screw is once more firmly bedded. The two screws on the inside always correspond to one on the outside and vice versa, and if there are two screws on the inside of one rail there will be one screw on the inside of the other rail on the same tie. In rare instances screws are put in with an electrical machine used principally for putting in dowels. Where long stretches of track are laid, such machines are very useful, but ordinarily for simple maintenance work the key is used. In a subsequent paragraph a hand machine for putting in these spikes is described in full. The relation of the screws to the rail is shown in Fig. 2, which represents a section of the rail, a wooden tie-plate, and a tie as used on the French Eastern Railway.

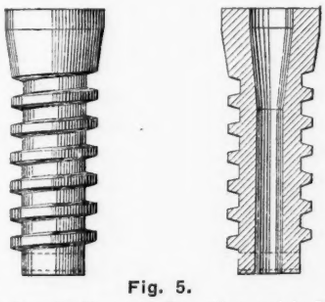


Fig. 5.

Screw Dowels, Shown in Face View and in Longitudinal Section.

After the screw-spikes are once put in little work is required to keep them in proper condition. The wood is compressed by the threads as the screw enters, and the pressure of the core upon this highly compressed wood opposes a resistance to the loosening of the spike. However, after the spikes have been in position for a few weeks they have to be tightened. This is not because the screws have loosened, but because the ties tie-plates and rails have settled so as to come closer together because of the pressure of moving trains. After the screws have been tightened they remain so for long periods of time. Once a year the section crew goes over the track with great care, testing and tightening each screw, and, if any of the screws no longer hold, they are taken out. The hole is then filled with a plug, a new hole is made in the plug, into which tar oil is poured, and the screw is replaced. The wearing out of threads of the screw does not occur very often.

It is impossible at this time to give any exact and trustworthy information as to the relative cost of maintenance of tracks equipped with ordinary spikes and with screw-spikes. In view of the fact that the screws do not work out of holes, as do the spikes, which means a less frequent replacing not only of fastenings, but of ties, it would appear that the cost of maintenance would be very much lower for the screw than for the spikes, and the condition of the track generally better. The first cost of putting the screws into position is somewhat higher than that for placing spikes. This is principally due to the longer time which the operation takes.

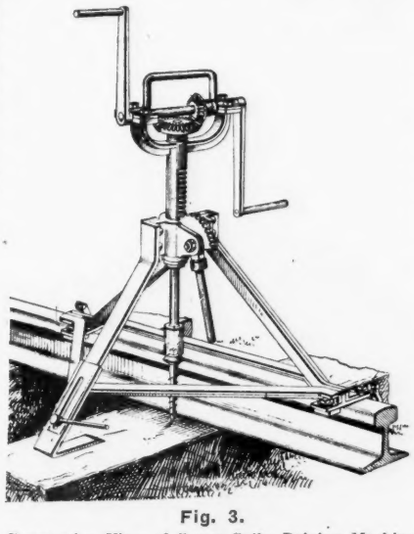


Fig. 3.

Perspective View of Screw Spike Driving Machine in Operation.

As already described, the method of putting in the screws used on the European railroads requires an ordinary key operated by two men. It was foreseen that this would probably prove too slow for American conditions, and on that account a machine was devised which would allow of a more rapid screwing in than with the laborious horizontal machine. Such a machine is the one illustrated in Fig. 3. The detailed design for this machine was drawn by Prof. A. L. Smith, of the Worcester Polytechnic Institute, Worcester, Mass.

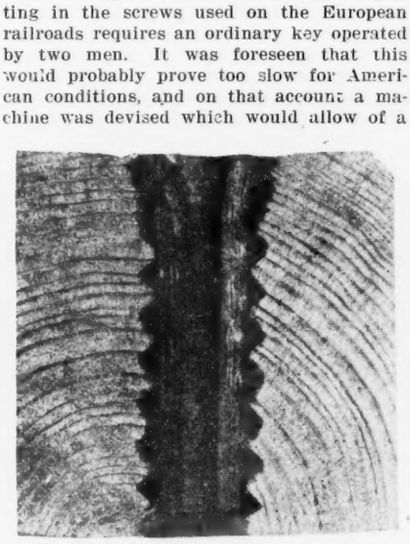


Fig. 7.

Cross Section of Pine Tie Through the Dowel.

A recent test made on the Pennsylvania lines with this machine showed that one could put in two screw-spikes while three spikes were being driven. While this operation requires a little more time than the placing of a spike, it must not be forgotten that the saving made possible by the absence of tearing the tie to pieces is very much greater than the loss of time. The chief objection which can be urged against the screw-spike at the present time is the matter of boring holes. In Europe this is done almost without exception at the treating plants, by the same machine which adzes the ties. In this country, with the numerous different rail sections used on almost every railroad, it will not always be practicable to bore holes in advance, and some method will have to be devised for boring holes out on the track by machinery. It is probable, however, that for stretches of new track, boring at the treating plant will be the simplest way to manage the problem.

Where single ties are renewed it will be possible to bore holes with the machine used for putting in the screws. All that will be necessary will be to replace the screwing key with a bit. It is expected that the tests now under way with screw-spikes on various roads in this country will enable a close estimate to be made of the actual cost of placing screws, compared with that of putting in spikes.

The screw-spikes manufactured in France and Belgium now cost about $4.45 per 100 kilos (220.46 lbs.). Each spike weighs about 18 ozs. It is expected that these screw-spikes will cost about 4 to 4½ cents in the United States.

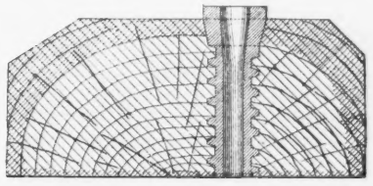


Fig. 6.

Screw Dowel in Position in Tie.

CONCLUSIONS AS TO SCREW-SPIKES.

*First*—The type of screw-spike which it is believed in the light of European experience will give the best service is that shown in Fig. 4. This screw combines the advantages of ease of making, cheapness and longer service than the other types of screws, and, moreover, wears out the thread of the wood less closer than wound screws. Tests with this screw are now under way on several of the roads in the United States.

*Second*—It is suggested that these screw-spikes be placed in two ways—four screws per tie and six screws per tie—according to the European model.

*Third*—As the screw-spike forms one of the proposed modifications of the present method of fastening, it is desirable that screws be tested on a broad-based rail without any plate, and also with steel and with wooden plates.

*Fourth*—In buying screw-spikes, only such as show a sufficient strength of head should be accepted. Most screws hitherto used have not had strength enough to stand the vertical blow upon the head.

*Fifth*—Recent tests show that the ratio of the holding power of the screw-spike, as compared with the common spike, ranges from 1.87:1 for white oak to 4.63:1 for long-leaf pine.

The result of lateral impacts shows that under the action of a side blow, such as comes on a rail a common spike is pulled out from one-fourth to one-half inch, while the screw-spike is not perceptibly started.

DOWELS FOR SCREW-SPIKES.

One of the greatest difficulties with soft timbers lies in the fact that the wood around the spikes wears out with considerable rapidity after the new tie has been put in ser-

vice. This wearing out not only destroys the tie, but also makes the track unsafe, since the rails are no longer held to the tie. A recent invention by a French engineer has already shown such remarkable results in the way of preventing wear around the spike that it is deserving of study and trial.

In 1896 this engineer called attention to a cylindrical screw dowel which he had devised for use with soft wood ties. This dowel (illustrated in Fig. 5) consists of a cylindrical piece of wood formed into a screw with a very wide thread. At the upper end the dowel is somewhat larger than at the lower, so that when it is screwed into place water cannot enter between the dowel and the tie. A hole is bored in the center to admit either a screw-spike or an ordinary spike. The dowels are made out of carefully selected pieces of such woods as beech or birch, which have been seasoned for several years, and are heavily creosoted. The dowels are screwed in by hand where only a small number are needed, but where the number is large machinery is used. Electrical machines have for several years been in use at the treating plant of the French Midi Railway. The machine consists of a small, 5-horse-power motor with a flexible shaft, mounted on four wheels, the gage of which can be varied at will. In actual practice a 5-horse-power and a 3-horse-power machine are used. The 5-horse-power machine bores the holes and shapes the screw-thread, and the 3-horse-power machine screws in the dowels and cuts off the heads. One man can easily manipulate one of these machines. Near Bordeaux, in Southern France, an average of 2,400 ties per day are provided with six dowels each. With hand tools the German company estimates that one man after brief practice can provide 15 ties with six dowels per tie in one day. Since four men can work with one set of tools, one man boring the hole, one cutting the screw thread, one screwing in the dowels, and one cutting off the top, it is possible to provide 80 to 90 ties with six dowels each in a day with two sets of hand instruments. From the greater rapidity with which Americans work, it will probably be possible to increase this number here.

One of the greatest advantages of the dowel lies in the fact that it can be applied to ties in which the spike holes have worn out. This is done by increasing the size of the old spike hole to the necessary diameter of the dowel and placing the dowel in position much as for the new tie.

The dowels fit very tightly into the wood. The great lateral pressure against the wood fibers is illustrated by the fact that when some ties which had been provided with dowels for five years were sawed through the pieces of the dowels were sprung out from the tie. Fig. 7 shows a dowel and new tie cut through the middle. The dowel had been in position in this tie about three months. It will be noted that some of the creosote with which the dowel had been treated had already penetrated laterally into the soft wood of the tie. Great stress is laid upon this, for it proves that the wounding of the tie made by screwing in the dowel is of so light a character that not only is there little space for water to enter, but the dowel itself helps to make the wounded surface impervious to the action of water, and protects it against fungi.

A large number of tests have been made to show the higher resisting power to both vertical and lateral pulls of screw-spikes and spikes when inserted in the dowel. A very much greater resisting power of the spike or screw-spike within the dowel is at once evident. A further valuable fact is that not only does the dowel protect the surrounding wood against the wear of the screws or spikes, but the heads of the dowels serve partially as tie-plates. The experience of the last five years on the Paris-Lyons-Mediterranean Railway of France with soft French southern pine is worthy of note. On stretches of track over which an average speed of 100 kilometers (62.1 miles) was made, a number of old ties were provided with dowels in 1896, and at the same time a number of new ties without dowels were laid. In 1902 the new ties had already been worn out, while the old ties with the dowels showed practically no wear. If this should prove true in this country, it might be possible to do away with the expensive steel plates now generally in use. The following estimate made by a German engineer shows how the European engineers who have tried dowels look at the matter:

Estimating the price of a treated pine tie, including the placing of the same, at 4 marks (95 cents), the annual charge at 3½ cents with interest would be about 55 pfennigs, if it is assumed that such a tie lasts ten years. The price of providing one tie with six dowels can be estimated at 1.10 marks (26 cents). If one uses old ties which have been taken out of the track and provides these with dowels instead of replacing the old ties with new ties, the cost of providing ties with dowels will already pay for itself after two years' use of a doweled tie. It has already been proved at this date that the increase in the length of life is very much more than two years. If the increased length of life be estimated at from eight to ten years, about 4 marks (95 cents) per tie will be saved.

The best proof of the high estimation in which Europeans hold the dowel is the great extent to which they are being adopted. The Prussian State Railway this year provided 350,000 old ties with dowels, and the Paris-Lyons-Mediterranean Railway of France has for several years been putting dowels in its ties. The same is true of a certain number of Spanish roads which have been putting in 250,000 to 300,000 dowels annually. On the Marienfelde-Zossen stretch, on which the high speed tests of the Prussian Government were made recently, all the ties were provided with dowels. The increased strength thereby given to the track is testified to by the military authorities in charge of track construction.

There can be no question but that the introduction of the dowel is one to be welcomed by all engineers. The great increase in holding power which it gives both to ordinary spikes and to screw-spikes cannot be questioned, and any device tending toward increased stability ought to be welcome. The adoption of a device of this kind in the United States will depend largely upon the ease with which it can be applied. It is believed that the great problem of how to make a spike hold in soft wood ties as well as it would in an oak tie may at least be partially solved by the use of this device. If it turns out that it is possible to make a soft wood like loblolly pine or red oak serve the same purpose as the harder white oak or longleaf pine, an important step in the utilization of our forest resources will have been made.

## Railroad Shop Tools.

*(Continued.)*

### WHEEL PRESSES.

The hydraulic wheel press shown in Fig. 1 is made by the Niles-Bement-Pond Company. This machine has a capacity of 200 tons and will take wheels 44 in. in diameter. The machine is mounted on a base plate, but no strains are transmitted to this plate—all of the pressure being taken by the tie-bars. The cylinder is lined with copper, expanded into place and burnished. The piston is packed with leather. The pump is double acting, with two sizes of plungers, and has three speeds of delivery. The delivery may be instantly stopped by trip-valves without shifting the belt. The ram is counterweighted for quick return when the release-valve is opened. The safety valve can be set to open at any desired pres-

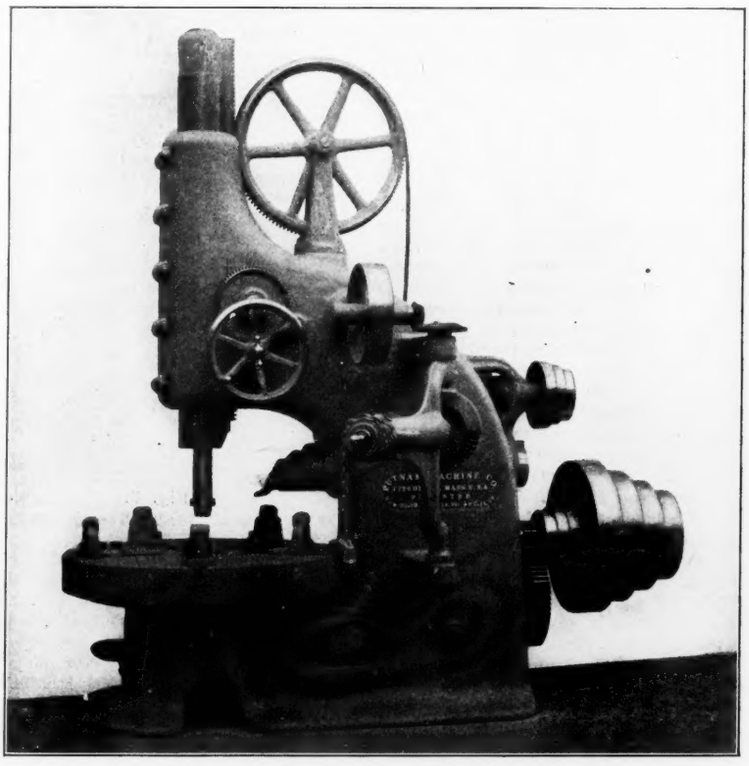


Fig. 3—The Putnam No. 2 Car Wheel Borer.

sure and is protected from tampering by a lock box cast on the cylinder. The pressure gage is graduated for total tons pressure and for lbs. per sq. in. A water tank which supplies the pump and takes the discharge is bolted under the cylinder. The resistance head is supported by rollers running on ways on the base of the machine, and is held in position by steel keys placed in the tie bars. The driving pulley is 36 in. in diameter for a 6-in. belt, and should run at 100 r.p.m. When desired, this machine can be run by a direct connected motor.

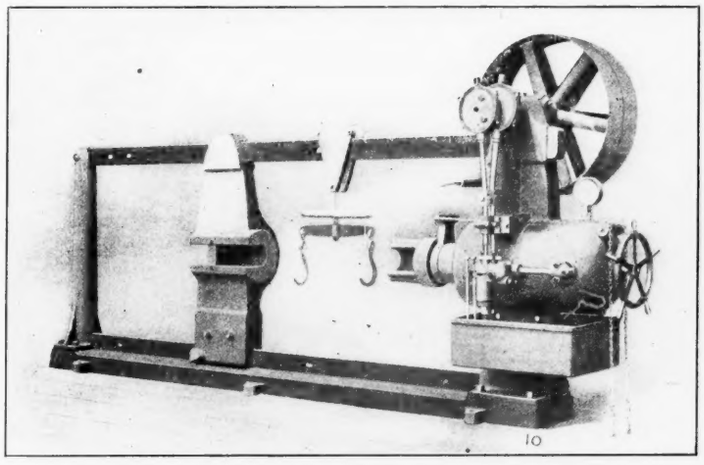


Fig. 1—Niles-Bement-Pond 44-in. Hydraulic Wheel Press.

The 96-in. hydraulic wheel press shown in Fig. 2 has a capacity of 400 tons and is used for locomotive driving wheels up to 90 in. in diameter. The distance between the tie-bars is 96 in. The maximum distance between the ram and the resistance head is 8 ft. 8 in. The opening in the resistance head is for axles 12 in. in diameter. The double-acting pump has two sizes for plungers and three speeds of delivery, which are under instant control. This machine is equipped with an elevating mechanism by which the machine may be raised to any desired height above the floor, so that wheels of different diameters can be rolled into position, thus avoiding the necessity of handling the wheels by cranes. The machine is guided by two stands carrying guide rods. A motor operates the pump and elevating screw. When this machine is set up in the shop, all of the lower part shown in the illustration is placed below the floor.

This machine is made by the Niles-Bement-Pond Company.

BORING MILLS.

The Putnam Machine Company's No. 2 car-wheel borer is shown in Fig. 3. This machine will receive wheels from 15 in. to 48 in. in diameter, and will bore either straight or tapered holes. The chuck has five steel jaws operated both universally and independently. The chuck runs in a babbitt-lined case, and the chuck spindle is hollow, which allows the borings, chips, etc., to fall into a pit in the interior of the machine. The vertical pressure and end thrust of the cutter head is received on an anti-friction ball-bearing having steel seats. The driving cone has four changes for a 5-in. belt, and the countershaft is so arranged that the momentum is checked by a friction brake when the machine is stopped. The vertical boring spindle is provided with take-up bolts and has six changes of speed, ranging from $^3/_{16}$ to $^5/_8$ in. The spindle can be run up into the frame so as to clear the throat of the machine and give full play to the crane when setting up the work. The boring spindle is equipped with a safety stop which automatically stops the machine, after the cutters pass through the wheel. The hub facing spindle can be worked by hand or can be operated automatically with the boring spindle. Each machine is furnished with one patent cutter head carrying six cutters of high speed steel. The weight of the machine is 18,500 lbs.

The accompanying illustrations, Figs. 4 and 5, show the 34 in. vertical boring and turning mill made by the Colburn Machine Tool Company. This mill will take work 34 in. in diameter and the clearance under the cross rail and the turret is 14 in. and 22 in. respectively. The machine has 16 changes of speed ranging from 2⅜ to 68⅜ r.p.m. Both vertical and horizontal feeds are positive gear driven and are provided with adjustable automatic stops. The chuck is both universal and independent. To pre-

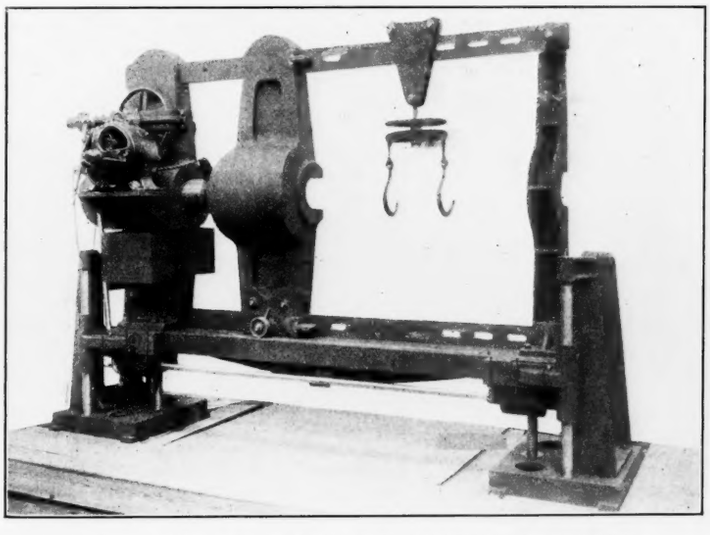


Fig. 2—Niles-Bement-Pond 96-in. Hydraulic Wheel Press.

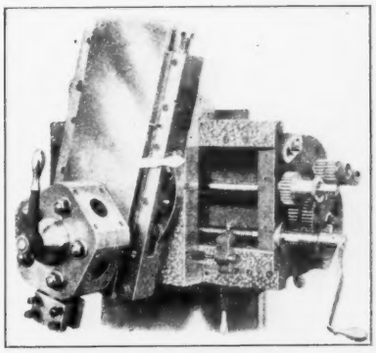


Fig. 5—Detail of the Colburn Mill.

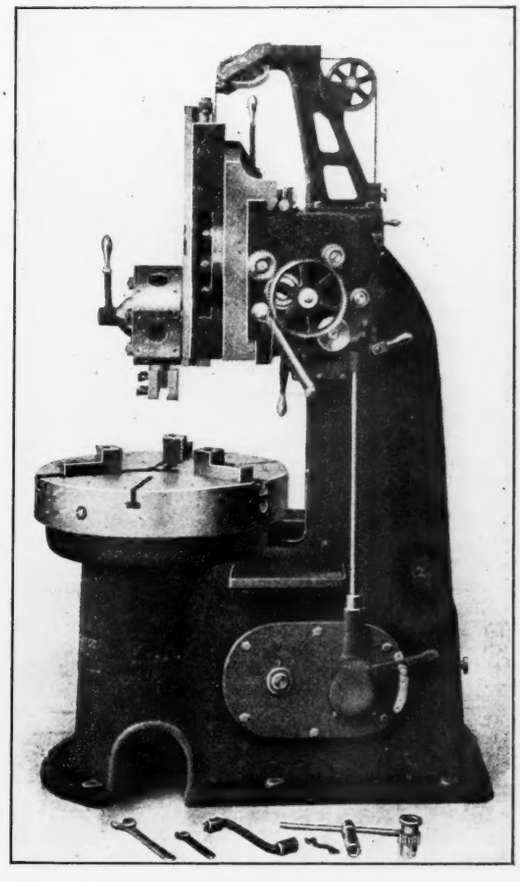


Fig. 4—The Colburn Boring Mill.

vent any possibility of the chuck jaws slipping, interlocking teeth are milled in both the jaws and the slides. The driving cone shaft is placed parallel with the cross rail, and is belted back to the countershaft, thus leaving a clear space overhead for crane service. A cast-iron gear is bolted to the chuck, so that there is no twisting strain on the spindle and it is driven by a steel pinion through a train of gears. The ratio of the constant train is 7½ to 1, and the ratio of back gears is 45 to 1. The 16 changes are graded to give a perfect geometrical progression. The spindle is 6 in. in diameter and runs on a bronze shoulder ring. The vertical slide has a travel of 18 in. and can be operated either by hand or power. It is carried on a swivel saddle attached to the cross slide by a central stud and is clamped to the cross slide by four bolts, working in a circular T slot. A graduated scale 18 in. long is attached to the turret slide cap and is parallel with the turret slide. The turret slide has an adjustable pointer which moves over this scale and indicates the travel of the turret. The turret slide can be swiveled 30 deg. either side of the perpendicular. The cross slide has a travel of 15½ in. and can be operated either by hand or power feed. An adjustable automatic stop is provided for tripping the feed. The slide can be clamped to the cross rail without having to use a wrench. The turret is 10 in. in diameter and has five sides. Each side is 5⅝ in. long and has a hole to fit tool shanks 2¼ in. in diameter. A micrometer dial is set over the collar on the cross feed screw. This is useful for finer adjustment of the cut. The machine is arranged so that a thread cutting attachment can be applied. The floor space required for this machine is 4 ft. 6 in. x 5 ft. 1 in. The net weight of the mill is 5,500 lbs.

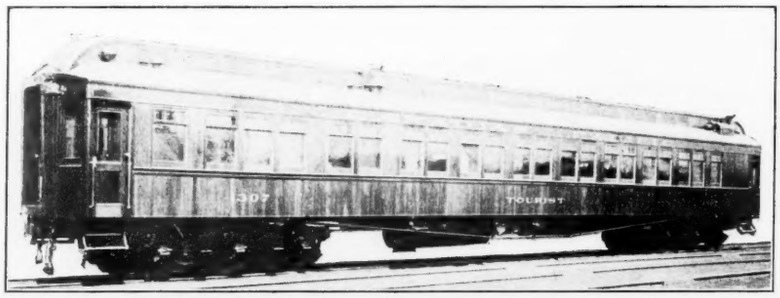
*(To be continued.)*

## Canadian Pacific Tourist Sleeping Cars.

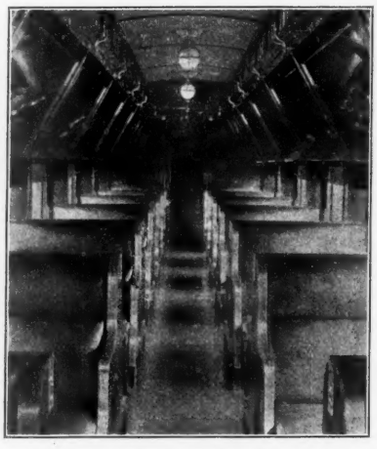
The Canadian Pacific is building 27 tourist sleeping cars in its Montreal shops. Eight of these cars have already been finished and put into service between Boston, St. Paul and Vancouver. A number of new features have been embodied in the design and the cars are as substantial and comfortable in everyway as the standard sleeping cars without, of course, having such luxurious interior appointments. They are 79 ft. 10 in. long over vestibules and 9 ft. 10½ in. wide over side sills. The framing is Canadian Pacific standard with ⅝-in.x7-in. iron flitch plates in the side sills, ¾-in.x7-in. plates in the end sills and ½-in.x6-in plates in the side and end plates. In addition to this all the end posts have ¾-in. x 4-in. iron flitch plates built into them and these are lapped over and bolted and riveted to the sill and plate flitch pieces, making the end of the car practically non-telescopable. The car body is stiffened with 1⅝-in. truss rods, which pass under cast-steel queen posts riveted to the 8-in. steel deck-beam needle beams.

The body side framing is yellow pine. The posts are 1¼ in. x 4⅛ in. with the outside corners rabbeted ¾ in. deep to receive the whitewood siding which is laid on flush. This siding is carried up from sill to plate and over it is laid the thin mahogany finish which is used on all Canadian Pacific passenger equipment. The exterior finish is varnish over the natural wood and the only ornamentation is narrow gold striping. The windows have double top and bottom sash, the outside top sash having three panels of beveled plate glass. Standard wide vestibules are used and the cars are mounted on 6-wheel trucks with 40-in. steel-tired wheels.

The main compartment of the car is divided into 14 sections in the same way as the standard sleeping cars. The seats, backs and head pads are upholstered with dark-colored leather. Each berth is supplied with a spring mattress, hair mattress, feather pillows, blankets and the necessary linen. At one end of the car a kitchen is provided, where passengers can prepare their own meals. It contains a steel range, sink with hot and cold water and ample cupboard room. Adjoining the kitchen is a smoking room furnished with leather and wicker upholstered furniture. Washing facilities for men are provided in this compartment and




Exterior of New Canadian Pacific Tourist Cars.



Interior of Tourist Sleeping Car.

the men's saloon leads off from it. At the opposite end of the car is the heater room, linen storage locker and two ladies' toilet rooms furnished with hot and cold water.

The car is lighted by acetylene gas made by the Toltz-Lipschutz system. The center lamps have opal globes and four branch burners and when all the burners are lighted give ample illumination.

We are indebted to Mr. W. E. Fowler, Master Car Builder of the Canadian Pacific, for the illustrations and details of the description.

## Train Registers and Their Bearing on the Collision Record.

BY H. W. FORMAN.

Rule No. 195.—Both conductors and enginemen are responsible for the safety of their trains, and, under conditions not provided for by the rules, must take every precaution for their protection.

Rule No. 83.—A train must not leave its initial station on any division, or a junction, or pass from double to single track, until it has been ascertained whether all trains due, which are superior, or of the same class, have arrived or left.

Train registers play an important part in the safe movement of trains, yet they are not always rightly designed or properly located and used. They are too cramped: insufficient space is allowed for a conductor to write in the information required. Allowance of ¾ in. will be made for the names of conductors, and Conductor Schillinghauser will be expected to write his name within that space without encroaching upon and obscuring vital information in the adjoining column, which may be intended to show whether or not his train is displaying signals, simply because Conductor Hill can do so. It would have been well if the Train Rule Committee of the American Railway Association had suggested a train register form, as it no doubt would have been adopted by companies using Code rules. It will be necessary to somewhat qualify this remark, however, as there would be little relief or benefit derived from a standard train register if it possessed some of the objectionable features of certain standard code forms, the train order blanks, for example. The fact that a train order is often addressed to several trains moving in opposite directions seems to have been overlooked by this committee, as not enough space was allowed in the "19" and "31" forms to permit this to be done.

At points where both main line and branch trains are required to register one book is often used in common by all. At district terminals the book will be left lying on the counter where last used by the conductor who consulted it or registered. Often, in such cases, the register for east-bound trains may be found on that part of the counter which is intended for the use of trainmen of trains going in the opposite direction. A revolving train register holder can be made for about $3, which will keep each register in its proper place. Some train registers have pages long enough to accommodate trains for several days and are made up into books of several hundred pages. The entire page is filled up and long before the book is filled it becomes badly soiled. Its leaves are torn and it is almost a wreck. Again, a practice is followed of using the same page for trains arriving and leaving. First, No. 3 will be shown with green signals and perhaps 2d. No. 30, with no signals, will appear directly underneath to trap the unwary. Or No. 6, due to arrive at the end of its run on July 20th, may meet with delay and not reach its destination until after midnight and register on the page set apart for trains on the 21st. Later on, an inferior train may in checking the register assume that, as No. 6 of the day before is twelve hours overdue, it need not be checked for and that No. 6 of the 21st has arrived. Or No. 6 may be running in sections and part register on one page and part on another. Of course, if the time and other circumstances, such as running a train in advance of its schedule, were carefully considered there would not be accidents due to these irregularities; but registers are not always studied as carefully as they should be. Men generally come to the register when

they are ready to start on the trip and their orders are often such that they are in a hurry to leave as soon as possible.

If a regular train is due at a station on the 20th of July it should be registered on the page for that date, even though it does not pass such point until the 21st. Extra trains should be registered on the page for the actual date of their arrival or departure. There should be a train register of not over one hundred leaves permanently located for each district or branch, and its pages ought to be only long enough to accommodate an average day's business, using a page for each day of the month.

In drafting train registers three essential features should be given the most thought and be placed where they will at once attract the eye—the number of the train, signals displayed by it, and its engine number. Some registers first provide a column for the train number,then its section, and, nearly last of all, as if it were unimportant and a chance thought, a column to write in the signals displayed by it. Thus 1st No. 4 may be shown as "No. 4, 1st section." The section should be the first thing to arrest the attention, next the train number, and then its signals. Instead of allowing a column only half an inch wide for the section and train number, a full inch or more should be provided. The column for "green" or "no signals," if put between the train number and the engine number, will separate these groups of figures and thus may prevent those who must be governed by this form from mistaking an engine number for a train number.

Three of the most trustworthy and experienced conductors whom the writer has ever known have overlooked opposing superior trains at initial registering stations. One case came about through checking a branch train's engine number, which happened to correspond with the number of the main line train, which should have been waited for. This occurred where the same register was used for both main line and branch trains. The other two conductors actually overlooked trains, as they afterward privately confessed, but were prevented from colliding with them by the despatcher remarking when he cleared them, "You wait here for No. ——." I am prepared for the exception that may be taken to this seemingly unnecessary precaution; that it divides the responsibility and that what is everybody's business will eventually only be perfunctorily done, or that the conductors will depend too much upon the despatcher. But I know a number of despatchers of many years' experience who never fail to impart this information. No one can say how many accidents they may have thus averted, as no conductor cares to come right out and admit that had not the despatcher reminded him of a train he would have overlooked it; but there is evidence available that at least seven collisions have been prevented in this manner during the past quarter of a century. No doubt almost any despatcher of several years' experience can cite additional instances.

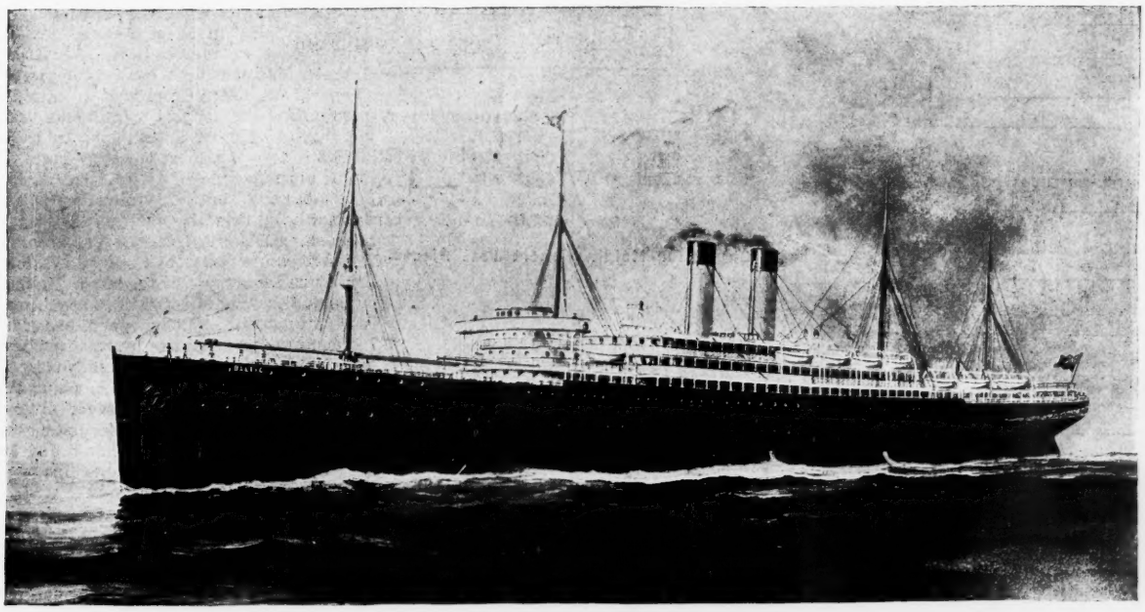
Run trainmen hard and call them out of bed about three o'clock in the morning, after having allowed them only five or six hours' sleep, and their minds are not so clear as that of the despatcher, who works regularly only eight hours of the twenty-four, and who has every train down on the sheet before him, with a good light to enable him to note their location. A few years ago an operator at a registering station at the end of double track delivered a clearance card to an early morning freight train, opened the switch and allowed it to proceed against a first class train which was due eight hours before, and which had been on time for months, but was late on this fatal morning. The train was overlooked by seven men. A suggestion to the operator by the despatcher that the freight train would wait at that station for the superior train would have reminded all of them of it and the great loss of life and property which resulted would never have been recorded. When a conductor or an engineman overlooks a train and moves against it he is considered unsafe and often is taken out of service permanently or for sixty days; but the despatcher and operator are seldom disciplined for failure to remind these men. I suppose this is a correct principle, as it is thought by many to be in the interest of good government to never look beyond the person who clearly is responsible for an accident. But my sympathy is with the man who is trapped. It seems to me, for instance, that the despatcher has not performed his full duty when he issues all the orders that a train needs, except the order to run extra, and then shifts the entire responsibility for the train going without this order upon the conductor and engineman.

There seems to be an impression that Code rules do not require enginemen to check registers. I will not here contend that they do, but it certainly cannot be claimed that they are forbidden to do so. If the conductor and engineman are both literally held responsible for the safety of the train, as provided in Rule 105, then it would seem that the enginemen, as well as conductors, should know, by examination of train registers, or by other means than verbal assurance of conductors, that at least superior trains have passed; to protect the company, the passengers, themselves and other employees.

I will not say that enginemen should always check registers at intermediate stations; but can they not get around five minutes earlier and check up the most vital one of them all—the one at their starting point? It is this register which is giving the most trouble and it is at the initial station where so many trains are overlooked.

### The White Star Steamship Baltic.

The accompanying illustration shows the Baltic, the newest addition to the White Star fleet, which leaves New York to-day on her first trip East. The Baltic is the largest steamship in the world, being of the same class as the Cedric and the Celtic of the same line, but 27 ft. longer (one plate), and is expected to make the ocean trip in 24 hours' faster time than these ships. The Baltic is 726 ft. long, comparing with 691 ft., the length of Brunel's Great Eastern. The tonnage of the Baltic is 24,000 gross. The gross tonnage of the Great Eastern was 22,500. The Baltic's cargo capacity is 28,000 tons, and she can carry this great bulk of freight at a speed of 17 knots on a coal consumption of about 250 tons a day. Low consumption is, of course, the noteworthy thing about the great, modern transatlantic freight and passenger carriers which have been built within the last few years to run at something less than express speed. The Teutonic, built in 1889, as an express



The Steamship Baltic.*

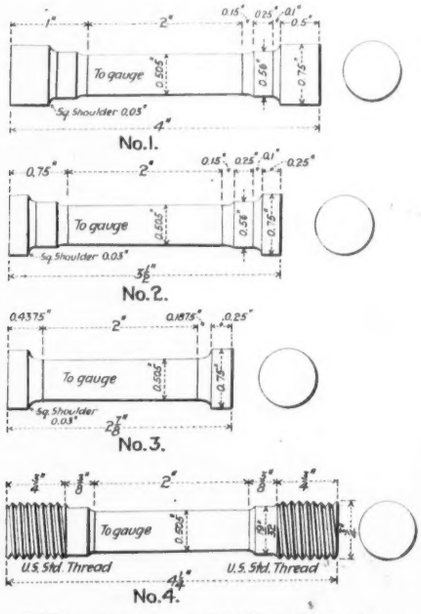
*Photo. courtesy Am. Syren & Shipping.

steamer, has a speed of 20 knots, but carries an insignificant dead weight tonnage. With each vessel running at its maximum speed, her coal consumption is not far from double that of the Baltic. The latter vessel represents the perfection of the modern type of carrier, which, by the sacrifice of a day in running time, compared with the express steamers, can carry a cargo enormously greater at half, or less than half the coal consumption. The new fast German steamers burn, in practice, approximately three times as much coal as the Baltic does, to pay for their speed.

The Baltic was built by Harland & Wolff, Belfast, the builders of the White Star fleet. She has quadruple expansion engines driving twin screws. The passenger accommodations provide for 3,000 and a crew of about 350 is carried.

### A Chuck for Holding Short Test Pieces.

At the Atlantic City meeting of the American Society for Testing Materials, T. D. Lynch, of Pittsburg, described a chuck designed to hold physical test pieces without the usual necessity of threading the ends. This chuck has been in use in the material and testing department of the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., for about two years; it is simple and easy to apply, gives

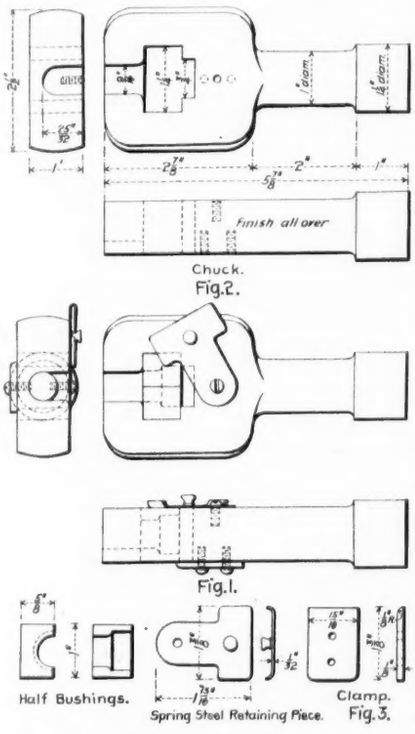



Different Forms of Holding-Heads for Test Pieces.

perfect alinement, saves threading and permits tests from minimum stock: Fig. 1 shows the assembled chuck; Figs. 2 and 3 show in detail the component parts. The head and neck are similar to the old chuck for the standard threaded-end test pieces. The body is 2⅞ in. x 2¾ in. x 1 in. with a chamber 1¼ in. x ¾ in. extending through it to receive the split bushings. Adjacent to this and over it is provided another chamber ¾ in. x ¼ in. to receive the end of the test piece that may extend above the bushing.

A slotted hole extends from the chamber to the bottom of the chuck to provide space for the test to assume proper alinement. The half bushings are of tool steel and so made that the shoulder of the test piece will fit snugly into them when put together. The outside of the half bushing is accurately made so that when put together in pairs they will slip easily into the chamber. A clamp is fitted to the back with two small screws and extends over the end of chamber to hold the bushings when they are pushed home. A retaining piece made of spring steel is attached to the front of the body by a screw, permitting a side motion. When drawn down it holds the bushings and test firmly in place, and when pushed to one side the bushings can be readily removed.

Fig. 4 illustrates three styles of holding-heads for specimens, used successfully in this chuck. No. 1 is 4 in. total length, and is recommended when there is plenty of stock. No. 2 is 3½ in. total length, and shows the proper proportion when the tests are but 3½ in. long. No. 3 is 2⅞ in. total length and is the minimum length so far




Chuck for Holding Short Test Pieces.

used in this chuck, maintaining a constant test section of 2 in. gage length and .505 in. diameter. There has been no noticeable difference in the results of tests due to the variations in total length. Even with the shortest piece, all tests so far conducted have broken near the middle, except for local flaws such as would affect any test regardless of holding devices. No. 4 is 4¼ in. total length, with threaded ends, and corresponds in every way to the standard adopted by the society, except the diameter is .505 in. instead of .5 in. This was used with the ordinary threaded chuck, until replaced two years ago by the one just described.

### Railroad Building in West Africa.

In April Mr. Frederick Shelford read a paper before the Royal Colonial Institute in London, on "The Development of West Africa by means of Railroads." In discussing the cost of building he asked that due allowance should be made for the fact that the lines had been built through dense tropical forest in the worst climate in the world. These conditions involved short tours of service, constant changes of staff in every grade, very heavy rainfall, scarcity and inferiority of unskilled labor and the complete absence of skilled labor, landing difficulties and the necessity of carrying on construction entirely from one base. Further allowance must be made for the native revolts and military operations which have occurred in each case. The cost of the different lines, including permanent bridges, headquarters, establishment and rolling stock, etc., complete, Mr. Shelford placed as follows:

| | Mileage. | Total Cost. | Cost Per Mile. |
|---|---|---|---|
| Sierra Leone Railroad.. | 222 | $4,656,638 | $20,976 |
| Gold Coast Railroad.... | 170 | 8,521,960 | 50,129 |
| Lagos Railroad* ..... | 125 | 4,291,190 | 34,328 |

*Cost of main line to June 30, 1903.

How the cost compared with that of other African railroads will be seen from the following figures:

| | Mileage. | Total Cost. | Cost Per Mile. |
|---|---|---|---|
| Uganda Railroad..... | 584 | $26,973,000 | $46,187 |
| Congo Railroad..... | 250 | 12,636,000 | 50,544 |
| Cape Gov't Railroad... | 2,089 | 106,153,170 | 50,815 |

In considering these figures it must be remembered that the gage of the Sierra Leone and of the Congo Railroad is 2 ft. 6 ins., while that of the Gold Coast, Lagos and Cape Government railroads is 3 ft. 6 in. and that of the Uganda Railroad is one meter. There was one important point, Mr. Shelford said, to be noticed with regard to railroads in West Africa—that the further they are built the greater is the speed of construction and the less the cost, provided they are authorized and organized as a whole, and not in sections. This is due to the better climate and the more open country found further inland, the greater facilities given to the staff to organize the machinery of construction, the increasing confidence and efficiency of the native laborers and the existence of an established base with quarters for the staff, workshops and improved landing facilities.

In summing up the present development of railroads in West Africa, Mr. Sheldon said that in Sierra Leone a railroad 222 miles long had been nearly completed, traversing the colony from west to east, forming probably the longest continuous length of railroad of 2 ft. 6 ins. gage in the world, and being the most cheaply built line on the western side of Africa. In Lagos a 3 ft. 6 in. gage line, 125 miles long, had connected up the three largest towns on the West Coast of Africa—Lagos, Abeokuta and Ibadan. On the Gold Coast a 3 ft. 6 in. line, 170 miles long, had placed Kumasi, the capital of Ashanti, within 16 days' journey of Great Britain. The French had connected St. Louis and Dakkar by rail, and were proceeding with meter gage railroads connecting Kayes and Koulikoro in Senegal, Konakry and Kouroussa in French Guinea, and Kotonou and Paouignan in Dahomey. The Belgians had connected Matadi and Leopoldville with a 2 ft. 6 in. gage line, and were proceeding with extensions. With regard to the future development of West Africa by railroad building, the field is a very large one. The immense area of Western Africa would not be adequately served by one hundred times the length of railroad at present built. All railroads, however, in West Africa, with few exceptions, must at present be developmental, and must be built without immediate prospect of a return upon the cost of construction, since it will take time to educate the natives and develop trade to such an extent as to return interest on the capital expended. Under these circumstances private enterprise cannot be expected to assist in building railroads.

The question is whether the Imperial Government should not assist the Colonies later on by grants of money to build railroads which are most urgently needed. It was mentioned that the French schemes for railroads in West Africa, now in process of carrying out, entirely dwarfed the British lines.

# GENERAL NEWS SECTION

## THE SCRAP HEAP.

The New York Railroad Commissioners, July 11, announce as their decision relative to the Van Cortlandt grade crossing accident, on June 12, that the accident was caused by the carelessness of the chauffeur of the automobile which was struck. The commission recommends that the crossing be equipped with gates on both sides of the tracks and that a man be on duty there at all hours.

Judge Thayer, in the United States District Court at St. Louis, July 9, sentenced E. J. Gildersleeve, a ticket broker, to 15 days in jail. Gildersleeve has been an old offender, and was reported in these columns last week as having been fined $250. The judge said that it was clear that fining the defendant had no effect, and that the court felt compelled to try the expedient of sending him to jail.

According to press reports, rains in the greater part of Kansas, Nebraska and Oklahoma have caused serious damage to railroad properties. All rivers throughout eastern and central Kansas are said to be out of their banks, and the tracks of the Atchison, Rock Island, Missouri Pacific and other roads, were submerged for a distance of 100 to 200 miles west of Kansas City. The loss is said to be serious, but not so bad as it was last July in the same territory.

Announcement is made that the Chicago & Eastern Illinois will discontinue its suburban passenger service August 1. The service heretofore performed by this road will in the future be undertaken by the Chicago & Western Indiana, which is required, under its municipal franchise, to provide suburban service at fixed rates, and has purchased new equipment for the service. The suburban passenger service of the Chicago & Eastern Illinois, on account of low rates and small amount of traffic, has been unprofitable.

### Grand Trunk Car Ferry.

The contract for building the largest car ferry on Lake Michigan, to run between Grand Haven and Milwaukee, has been let by the Grand Trunk to the Craig Shipbuilding Co., of Toledo. The boat will carry 40 cars and is to be completed in 1905 at a cost of $400,000. It will be 300 ft. long, 56-ft. beam and run 18 miles an hour.

### New Drydock at Brooklyn Navy Yard.

Revised plans and specifications for the new drydock at the Brooklyn Navy Yard have been completed in the Bureau of Yards and Docks at the Navy Department, and bids will be opened on August 27. The former bids for this structure, opened January last, were regarded as excessive, and all bids were rejected, as they exceeded the appropriation available. Since January the plans have been materially modified, so as to omit certain piling, substitute galvanized iron for composition metal, etc. The dimensions of the dock remain as before.

### Favorable July Crop Report.

The July report of the statistician of the Department of Agriculture gives a much higher estimate of the condition of the corn crop than was the case at the same time last year. The condition is stated at 86.4, as against 79.4 last July, while the acreage has only been twice exceeded—in 1899 and in 1902. On the acreage given the statistician of the New York Produce Exchange figures an indicated corn crop of 2,537,268,000 bushels, an increase of over 293,000,000 bushels over last year's harvest. This indicates that the 1904 corn crop should be the largest on record, with the single exception of that of 1899. The wheat crop, according to the Produce Exchange figures, is 26,000,000 bushels ahead of last year's harvest returns, also. There are only three years in which the indicated crop has been exceeded.

### State Railroads in Baden.

At the close of 1903 the Grand Duchy of Baden owned and operated about 1,035 miles of railroad. On these lines approximately 21,904 men were employed. The debt at the close of 1902 was approximately $94,500,000. Statistics show a tendency for operating expenses to increase at a more rapid rate than gross earnings, and this has led to much discussion as to a remedy for the situation. In 1890 the ratio of operating expenses to gross earnings was 61 per cent., in 1902 it was 82 per cent., and in 1903, 72 per cent. In 1899 earnings amounted to $6,000,000, in 1900 $4,285,000, and in 1901, 1902 and 1903 earnings were $3,450,000, $3,500,000 and $3,284,000 respectively. The causes most frequently assigned for the unfavorable situation are a general business depression, heavy expenditures for improvements, higher cost of wages and losses due to accidents. Other causes for poor earnings are a low passenger rate due to the use of mileage books, and a lack of traffic agreements between the railroads and the several German states.—*Consular Report.*

### Architects for United Engineering Building.

The committee of the three national engineering societies and of the Engineers' Club this week made the selection of architects for the United Engineering, Building and the Engineers' Club. The competition was a mixed one; in addition to selecting six competent architects, the committee threw the work open to all comers and gave prizes to the best competitors in the open class. The committee received 26 complete sets of competitive plans for the two buildings, inclusive, comprising over 500 drawings. The assistance of Prof. W. R. Ware as expert adviser was obtained and all of the designs were carefully considered. The successful competitor for the United Engineering Building is Mr. Herbert D. Hale, of Boston, with Henry G. Morse, of New York, as associate architect. Mr. Hale has done a large amount of public architecture in New England and has constructed some Carnegie libraries, besides doing work for the New York Shipbuilding Company. The successful competitors for the Engineers' Club are Whitfield & King, of New York, who have done a large amount of work in New York City and who were also associated in work on the buildings of the Pan-American Exposition. The designs of this firm were also among those favorably considered for the United Engineering Building, awarded to Mr. Hale. The successful competitors in the open class for four equal prizes of $400 each, in addition to Mr. Hale, are: Trowbridge & Livingston, of New York; Frank C. Roberts & Company, with Edgar V. Seeler, associate, Philadelphia, and Allen & Collins, of Boston.

The United Engineering Building will occupy 125 ft. front by 100 ft. on West Thirty-ninth street, while the Engineers' Club, with a frontage of 50 ft. and a depth of 100 ft., will face on Bryant Park and the new Public Library. The United Engineering Building, aside from quarters for the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Institute of Mining Engineers, as well as other societies which will share in the accommodations, will have several fine auditoriums and a magnificent library. The club building will be about 11½ stores high, with the usual accommodations of a club and some 60 or 70 bedrooms for members. The work on tearing down the old buildings and the construction of the new is to be pushed vigorously and will begin shortly.

### Iowa Railway Club.

At the meeting of this club, held on June 13, the first paper was on stockyards at shipping stations, by Mr. C. W. Kelly, of the Chicago & North Western. Mr. Kelly laid down the principal requirements in regard to the location of a yard, and spoke of the necessity of being on guard against the demands of shippers for too many accessories. In the discussion on the paper, Mr. Horton advocated the paving of stock yards with brick. The soil of Iowa is so muddy at some seasons of the year that heavy hogs cannot be managed in the ordinary unpaved yard. At one station on his road the shippers boycotted the company until the yard was paved, which was done at an expense of $2,500. A paved yard suitably drained can be easily kept clean by the section men, and at much less cost than where the floor is made of old sleepers. It is all right to assign regular compartments to individual shippers, but care must be taken not to let the large shippers crowd out the small ones. Mr. Nettles, being asked as to the traffic side of the stockyard question, said the only fault he had to find with the yards at present was that they are too clean; in other words, the business is dull. His only trouble is to find the animals to put into the yards.

This discussion was followed by a paper by Mr. Campbell, of the Chicago & North Western, on the block system, describing the manual system as it is used on the North Western lines in Iowa. Permissive blocking is allowed only on the order of the train despatcher in each case. In the discussion which followed, a number of speakers declared their belief that when permissive signals are given, the enginemen do not strictly obey the instructions of the caution card, but depend on the flagman of the preceding train.

There was also a paper on tonnage rating, by Mr. V. F. Finch, Road Foreman of Engines, of the Chicago & North Western, and another by Mr. Bently, of the Chicago, Rock Island & Pacific. Mr. Finch spoke of the annoyances and losses caused by loading engines too heavily. To get the best service out of the men they must not be kept on the road an unreasonable length of time. It must be borne in mind that it is more difficult to move a train at night because, in consequence of heavy dews, it is much harder to prevent slipping of the drivers. If sand is used there is more liability of getting stalled. Mr. Finch would rate an engine at 80 per cent. of the maximum available drawbar pull. On a certain division, where the loading was reduced from 100 per cent. to 80 per cent. the freight tonnage per engine mile was increased 13 per cent., and the tonnage per train mile was increased 16 per cent., with a decrease at the same time

of 9.3 per cent. in the coal consumed per 1,000 ton miles. Since using treated water, however, the loading of the engines has been increased a little.

Mr. Bently's paper was in the same line as Mr. Finch's. If an engine is overloaded the company loses money in consequence of the time the engine has to be laid up in the shop to be repaired. "In making an engine pull every pound she can wiggle with over the entire division your engine crews are played out, your train crews are played out, the old war horse is played out, and you won't have an engine left on the pike that will pull a hen off her nest."

### Hall Signal Contracts.

Of the three recent contracts for automatic block signaling given to the Hall Signal Company, two are for electro-gas automatic semaphore signals operated on the "normal danger" system, and the third is for disk signals on a normal clear circuit.

The Illinois Central is to signal several stretches of the line between Fulton, Ky., and Memphis, Tenn. The length signaled is approximately 70 miles of double track, and 151 blades will be used, arranged as follows: Seventy double automatic electro-gas semaphore signals, 1 double electro-gas signal mounted on a bracket post, 4 single electro-gas signals and 5 slotted mechanical signals. Live wire signal circuits are used, with the signals normally at danger. The signals are equipped with iron mechanism and battery cases. Each signal is supplied with a counter.

The signal glasses are 6½ in. diameter and green glass is used for the night "clear" indication. The lamps are fitted with long time burning fonts and no reflectors are used. Battery wells, which are needed where the signal circuit is run ahead to break through a contact at a facing point switch, are of concrete and furnished with a frost breaker. The batteries are Edison, type SS, except the track batteries, which are of the gravity type. Relay boxes are of wood, with double doors. The relays for the track circuits are of 4 ohms resistance. All relays are furnished with silvered carbon sliding front contacts and platinum back contacts.

The switches are protected by breaking the signal circuits and shunting the track circuits through the switch instruments. Cross-over switches between main tracks "break and shunt" both tracks. The switch indicators, which are of the semaphore type, are inclosed in iron boxes mounted on iron posts. The indication of the approach of a train is given two blocks away.

The magnets and contact points are protected with style E-G lightning arresters. A coil of No. 6 copper wire buried in moist earth is used as a ground. The line wire is hard-drawn copper double braid weather-proof B. & S. No. 12 gage, with a No. 10 wire used as a common return. The following interesting mechanical tests will be used on the wire:

A piece of rubber insulation 4 in. long to be stripped from the wire and marks placed on it 2 in. apart. The piece is to be stretched until the marks are 6 in. apart, and, after being released, the marks must not be over 2¾ in. from each other. Also the piece must stand stretching until the marks are 8 in. apart before breaking. The wire must be capable of standing a 25 per cent. elongation and 30 twists in 6 in. without breaking.

The Lake Shore & Michigan Southern signals are for the line between Brocton, N. Y., and Erie, Pa., and between Indiana Harbor, Ind., and 100th St., Chicago. These signals are of the electro-gas type, as are all the automatic semaphore signals on this road. The distance is 49 miles of double track and 150 blades, partly on straight masts and partly on bracket masts, will be used.

The signals are arranged on the "normal danger" plan, and the signal circuit is of the line wire type. The signal wire is broken through a front contact on the track relay at all cut sections. Each track circuit has for protection against foreign current a 16 ohm relay connected in parallel with the track battery, as well as the 4 ohm-track relay at the other end of the section. Semaphore indicators are placed at all switches and indicators and annunciators at all interlocking towers and outlying switches.

Track circuits are carried through all interlockings, across all bridges and through all crossings. At all interlockings home signals are slotted and semi-automatic distant signals installed. The signal glasses are 8¾ in. in diameter and a white light is used for the "clear" indication. A single reflector is used with the company 8-day lamps.

The track circuits are not to exceed one-half mile in length. "Excello" gravity batteries are used for track circuits and caustic potash batteries for signal and indicator circuits.

The Staten Island Rapid Transit Railway Company has contracted for Hall disk signals on its North Shore line, between St. George and Arlington. A normal clear line-circuit is used and a home and a distant signal are mounted on a single yellow pine post.

Gordon cells, type No. 3, are used for the line circuits. These are to be kept in iron battery cases. On side tracks insulated joints of oak are used. On the main track Weber joints are used.

Switches are protected by a track shunt through a switch instrument. Sidings, back past the fouling point, are connected in parallel with the track circuit. No switch indicators are used.

Except for the details noted the specifications for the three installations are approximately the same.

### Allis-Chalmers Engine at the St. Louis Exposition.

One of the machinery exhibits at the World's Fair, at St. Louis, is an Allis-Chalmers engine coupled to a Bullock electric generator. The engine will develop 3,000 h.-p. when operating condensing at 150 lbs. pressure and running at 75 r.p.m. This engine furnishes the electric current for lighting the buildings and grounds, for which about 200,000 incandescent lamps are required. It is frequently employed for other purposes, sometimes operating the cascades and for general power purposes. Recently it was suddenly called upon to take the entire load ordinarily carried during the day by the power plant in the same building, and aggregating about 5,400 h.-p.

### Manufacturing and Business.

Fred Harris has severed his connection with the Rand Drill Company, of which he was formerly sales agent in Butte and Salt Lake City.

The American Turbine Engine Co., of Yarmouth, has been incorporated in Maine with a capital of $1,000,000. M. S. Watts, of New York, is President, and G. L. Marston, of Portland, Treasurer.

The American Rotary Engine Co., of Portland, has been incorporated in Maine with a capital of $500,000. M. W. Baldwin, of Portland, is President and G. C. Knight, of the same place, Treasurer.

The Brown Excavating Machinery Company, of Brooklyn, has been incorporated in New York, with a capital of $25,000, to deal in machinery. The incorporators are W. E. Brown, J. W. Rinker, F. R. Williams, all of Brooklyn, N. Y.

A. B. Sands & Son Co., of Brooklyn, is the name of a concern incorporated in New York with a capital of $20,000, to deal in machinery, by J. Jenkins, Montclair, N. J.; E. P. Sands, Brooklyn, N. Y., and J. H. Leonard, East Orange, N. J.

The Ideal Steel Co., of North Arlington, has been incorporated in New Jersey with a capital of $50,000 to make and deal in steel of all kinds. The incorporators are: Ernest C. Dalzell, of Bellville; John M. Bell and Horton H. Curren, Rutherford.

The working model of the concentrating plant built by the Allis-Chalmers Company, which is one of the State of Utah exhibits in the Mines and Metallurgy Building, is to be presented to the Utah School of Mines after the close of the Exposition.

The National Steel Truss Concrete Company, of New York, has been incorporated to do a general contracting business, with a capital of $50,000. The incorporators and directors are John B. Oakley, W. F. Winston, E. E. Woodruff, all of New York.

The McLean Balanced Draft Engineering Company, of East Orange, electrical and mechanical engineers, has been incorporated in New Jersey with a capital of $300,000. The incorporators are Charles A. Greene, Charles L. Beck and Joseph Gerard.

The Bettendorf Axle Company, of Davenport, Iowa, will hereafter be represented in the southwestern territory by J. G. Miller, with headquarters in the Commonwealth Trust Building, St. Louis, and in the southeastern section by A. C. Hone, with headquarters in the Memorial Building, Louisville, Ky.

The Coughlin & Sanford Switch Company, 25 Broad street, New York, is preparing to build a branch shop at Troy, N. Y., to include a main building 80 x 150 ft., to be used as a blacksmith shop. The company will soon be in the market for a full equipment of machinery, including steam and power hammers and forges.

Bids are wanted August 31 by the Board of Trustees of the Sanitary District of Chicago for turbines to consist of four units of about 6,400 horse-power each and two units of about 600 horse-power each under a head of 34 ft., each unit to be provided with a governor. Zina R. Carter is President of the Board of Trustees.

The Empire Grain Company, of Fort Worth, Texas, has bought four and one-half acres of land as a site on the 'Frisco track west of the city, on the Arlington Heights road, on which the company will at once build a large elevator and handling house of fifty cars, with a 100,000 bushels storage. The improvements will cost about $50,000.

The Belmont Iron Works, of Philadelphia, has bought a large tract of land at Eddystone, Pa., for a site for new works. The plans include a riveting shop, 60 x 300 ft., with a lean-to of similar size, to be used for a template shop and for storage purposes. On the other side of the double-track siding there will be a power house, consisting of a boiler and engine room, also a blacksmith shop, and one for riveting. The company will probably need for the riveting shop a bending and straightening machine, angle shears, punches, rotary straight shears, grinding and emery tools, a drill press, riv-

eters, a rotary planer and motors. All the machinery is to be electrically driven. W. W. Pharo, the Vice-President and Treasurer of the company, is in charge of the new work.

The Philadelphia & Reading Coal & Iron Company has given a contract to the Link Belt Engineering Company, of Philadelphia, to build what is said will be the largest coal storage plant in the world. The plant is to have a capacity of over 500,000 tons of coal, and will be located at Abrams, on the main line of the Reading Railway, near Bridgeport, Pa. The plant will consist of eight piles with a capacity of 60,000 tons each and a receiving capacity of 14,000 tons in ten hours and a discharging capacity of 10,000 tons in the same time. It is to be completed by next January.

### Iron and Steel.

At the meeting of the Steel Billet Pool, July 7, the present schedule of prices was reaffirmed. The meeting was harmonious, and there was practically no opposition to maintaining the present schedule of prices.

The exports of rails in the month of June amounted to nearly three times those of the preceding month, being a total of 21,201 tons. The total amount of steel billets, steel rails, steel bars, steel hoops and pig iron exported in June amounted to 42,000 tons, which is considerably larger than in any previous month this year.

## PERSONAL.

—Mr. A. C. Hone, the late General Manager of the Louisville & Atlantic Railroad, has opened an office in Louisville, Ky., and, among other things, will act as Southern representative of the Bettendorf Axle Company.

—Mr. George H. Longbottom, for a number of years Secretary, and for a time President, of the Rogers Locomotive Company, died at his home in Paterson, N. J., July 8, at the age of 47. At the time of his death he was employed in the New York office of the American Locomotive Company. Mr. Longbottom's connection with the Rogers Locomotive Company dated back to 1874, when he went to work in the machine shop.

—Mr. R. F. Hoffman, whose promotion to be Assistant to the General Superintendent of Motive Power of the St. Louis & San Francisco is announced, was for about two years an Associate Editor of the *Railroad Gazette*. For a time in 1902 Mr. Hoffman was with the Schenectady Locomotive Works of the American Locomotive Company. Later he went to Springfield, Mo., where he entered the mechanical department of the "'Frisco," as Assistant to the Superintendent of Machinery. Mr. Hoffman's office will be at St. Louis.

—Mr. R. B. Adam, a veteran merchant of Buffalo, and one of the most prominent citizens of that city, died recently. Mr. Adam was well known in railroad circles by reason of his being chairman of the Buffalo Grade Commission. This commission conducted a campaign on behalf of the city, lasting several years, and requiring skilful diplomacy for the abolition of the grade crossings in the thickly settled part of Buffalo. As a public-spirited citizen Mr. Adam was active in many directions. His mercantile establishment was of the highest standing. He was prominent in the Merchants' Exchange, and a generous supporter of the Young Men's Christian Association.

—Mr. John A. Middleton, the new Freight Traffic Manager of the St. Louis & San Francisco and the Chicago & Eastern Illinois, was born at Kingston, Ont., 48 years ago. Mr. Middleton has been in railroad service for the past 21 years, all of which time has been spent on the St. Louis & San

Francisco Railway and its successor, the St. Louis & San Francisco Railroad. He began as rate clerk in 1883, and was successively chief clerk, Assistant General Freight Agent and General Freight Agent, from which latter position he is now promoted to be Freight Traffic Manager.

## ELECTIONS AND APPOINTMENTS.

*Atchison, Topeka & Santa Fe.*—The duties of the Second Vice-President, so far as they relate to freight traffic, will for the present be performed by W. B. Biddie, Freight Traffic Manager, and so far as they relate to passenger traffic, by G. T. Nicholson, Passenger Traffic Manager.

*Atlantic & Birmingham.*—The office of President W. G. Raoul has been removed from New York to Atlanta, Ga.

*Bodcaw Valley.*—J. F. Wise has been elected Secretary.

*Brockville, Westport & Northwestern.*—W. J. Curle has been appointed Superintendent, with headquarters at Brockville, Ont., succeeding E. A. Geiger.

*Cananea, Yaqui River & Pacific.*—The offices of President Epes Randolph and Assistant General Manager and Chief Engineer E. A. McFarland have been removed from Naco to Tucson, Ariz.

*Central Indiana.*—H. Ramsey has been appointed Auditor.

*Chicago, Rock Island & Pacific.*—The jurisdiction of the following Rock Island officers (with titles as below) has been extended over the St. Louis, Kansas City & Colorado. The St. L., K. C. & C. was recently opened for operation and will hereafter be known as the St. Louis Division of the Rock Island: C. E. McKim, General Superintendent of Transportation; W. M. Hobbs, Assistant General Superintendent of Transportation; J. O. Crockett, General Superintendent, Kansas City; Thomas Roope, Superintendent of Motive Power. Mr. Crockett was formerly Superintendent of Mails and Telegraph, and is also appointed General Superintendent of the Southwestern District, succeeding H. E. Byram, resigned.

*Cincinnati, Hamilton & Dayton.*—Eugene Zimmerman has been chosen to act as President and George H. Cummings as Vice-President, pending the annual election in October.

*Cleveland, Cincinnati, Chicago & St. Louis.*—B. D. Lockwood has been appointed Mechanical Engineer, with headquarters at Indianapolis, Ind., succeeding R. L. Ettenger, resigned.

*Cumberland & Pennsylvania.*—J. H. Wheelwright has been elected Vice-President, and T. K. Stuart, Secretary and Treasurer. E. P. McKenna, General Freight and Passenger Agent, having resigned, that position has been abolished.

*Buffalo, Rochester & Pittsburg.*—Fred J. Harrison, hitherto General Foreman of the Lincoln Park and Du Bois locomotive shops, has been appointed Master Mechanic of the Pittsburg and Middle Divisions. Charles S. Diegel has been appointed to succeed Mr. Harrison as General Foreman of the Du Bois Locomotive Shops. M. J. Lynn, hitherto locomotive engineer, has been appointed Master Mechanic of the Buffalo and Rochester Divisions, with headquarters at East Salamanca, N. Y., succeeding J. A. Barhydt, resigned.

*Georgia, Southern & Florida.*—O. M. Grady has been appointed General Superintendent. The office of Superintendent, formerly held by Mr. Grady, has been abolished.

*Illinois Central.*—J. H. Wynne has been appointed Mechanical Engineer, with headquarters at Chicago, Ill., succeeding C. A. Strom, resigned.

*Intercolonial.*—W. H. Olive has been appointed Assistant General Freight Agent with headquarters at Montreal, Quebec, succeeding James Hardwell.

*Iowa Central.*—C. S. Hayden has been appointed Superintendent, with headquarters at Oskaloosa, Iowa, succeeding J. A. Davis, resigned.

*Jacksonville & St. Louis.*—J. Foulk, Master Mechanic, has resigned.

*Kanona & Prattsburg.*—J. C. Klinck, Secretary and Treasurer, has been appointed Manager also.

*Lehigh Valley.*—Robert W. Baxter has been appointed Superintendent of the Pennsylvania and New York Division, with headquarters at Sayre, Pa., succeeding J. A. Droege, resigned.

*Missouri, Kansas & Texas.*—The title of A. D. Bethard has been changed from Superintendent of Car Service to Superintendent of Transportation.

*Montana R. R.*—F. T. Robertson, Chief Engineer, has been appointed General Superintendent also.

*New York Central & Hudson River.*—K. C. Weedin, having resigned as Resident Engineer of the Middle Division, and the office of Resident Engineer of the Eastern Division having been abolished, Charles K. Lawrence has been appointed Resident Engineer in charge of construction on the lines east of Minoa, exclusive of the New York and Croton watershed districts, with headquarters at Albany. The jurisdiction of R. P. Johnston, Resident Engineer, has been extended to include that portion of the Fall Brook Sub-district on the Pennsylvania Division, south of Corning Yard, succeeding Mr. Lawrence.

*Oregon Railroad & Navigation.*—J. P. O'Brien, hitherto Superintendent of Rail Lines, has been appointed General Superintendent. The titles of M. J. Buckley and D. W. Campbell have been changed from Assistant Superintendent to Superintendent.

*Pullman Company.*—R. A. Forsyth has been appointed District Superintendent, with headquarters at Cincinnati, Ohio, succeeding C. C. Chase, resigned. F. D. Cook has been appointed to succeed Mr. Forsyth as District Superintendent at St. Louis.

*St. Louis & San Francisco.*—R. F. Hoffman has been appointed Assistant to the General Superintendent of Motive Power, with office at St. Louis, Mo., and D. E. Fitzgerald has been appointed Chief Motive Power Clerk at St. Louis.

*St. Louis, Iron Mountain & Southern.*—F. W. Green has been appointed Superintendent of the Little Rock Terminals at Little

Rock, succeeding F. E. Cary, who has been assigned to other duties.

W. J. Haynen has been appointed Master Mechanic, with headquarters at De Soto, Mo.

*St. Louis, Kansas City & Colorado.*—See Chicago, Rock Island & Pacific.

*Toledo, St. Louis & Western.*—G. W. Taylor has been appointed Superintendent of Motive Power and G. L. Dickover Superintendent of the Car Department, succeeding A. J. Ball, Superintendent of Motive Power and Equipment, resigned.

*Wabash—Pittsburg Terminal.*—The officers of this company are: President, Joseph Ramsey, Jr.; Vice-President and Chief Engineer, J. W. Patterson; Superintendent of the Pittsburg Division, J. W. Patterson, Jr.; Manager, Robert Blickensderfer; Freight Traffic Manager, W. D. Holliday; General Passenger Agent, C. S. Crane; Superintendent of Transportation, C. B. Adams; Master Mechanic, J. E. O'Hearne; Master Car Builder, C. S. Morse, and Superintendent of Telegraph, J. E. Taussig.

*Wheeling & Lake Erie.*—Charles B. Adams has been appointed Superintendent of Transportation, with headquarters at St. Louis, Mo.

## LOCOMOTIVE BUILDING.

*The Duffy Construction Co.* has placed an order for 18 locomotives with the Davenport Locomotive Works, at Davenport, Iowa.

*The Cincinnati, Hamilton & Dayton-Pere Marquette Consolidation System* is reported to have ordered 40 locomotives from the American Locomotive Co. No official confirmation of this was obtainable at the time of going to press.

## CAR BUILDING.

*The Southern* is in the market for 300 box cars of 60,000 lbs. capacity.

*The Denver, Northwestern & Pacific* is in the market for 50 box cars.

*The American Car & Foundry Co.* has miscellaneous orders for 42 cars.

*The Erie* has ordered 10 express cars from the American Car & Foundry Co.

*The Lehigh Valley* has placed an order for 100 cars with the Standard Steel Car Co.

*The Southern Pacific* has asked bids on nine combination smoking and observation cars.

*The Pennsylvania* is reported to have placed an order at its Altoona shops for 500 refrigerator cars.

*The Cincinnati, Hamilton & Dayton-Pere Marquette Consolidation System*, according to press reports, has ordered 5,000 freight cars from the American Car & Foundry Co.

*The San Pedro, Los Angeles & Salt Lake*, reported last week as being in the market for new equipment, is asking bids on 750 steel gondolas, 200 box cars, 8 mail cars, 10 baggage cars, 10 coaches, 10 chair cars and 8 dining cars.

*The Midland Valley* has ordered 500 wooden coal cars of 80,000 lbs. capacity and three cabooses from the Mount Vernon Car & Manufacturing Co. for September and October delivery. The special equipment for the box cars includes Simplex bolsters and brake-beams and Tower couplers.

## BRIDGE BUILDING.

Alma, Kan.—Bids are wanted July 25 by the Township Board for building the stone abutments and wing walls for a bridge over Illinois Creek in Farmer Township. J. H. Terrass is Clerk.

Bellows Falls, Vt.—At a recent meeting of the Bridge Committee contracts for the new highway bridge over the Connecticut River between Bellows Falls and North Walpole were let: For the steel superstructure to Lewis F. Shoemaker & Co., of Polsdon, N. Y., for $40,394, and for building the stone work to Joseph Ross & Sons, of Boston, for $4,545, making the cost of the bridge $44,939. The contract calls for a combination suspension and truss bridge to carry electric cars. The bridge must be ready for travel by December 1.

Boston, Mass.—Bids are wanted July 21 by the Superintendent of Streets for the superstructure of a bridge at Harvard street, Dorchester.

Canon City, Colo.—The County Commissioners have decided to build a bridge at the lower end of Fruitmere, to cost about $12,000.

Clinton, Iowa.—A tornado July 4 carried away three spans of the iron bridge over the Mississippi River, leaving an opening of 250 ft.

Denver, Colo.—Bids are wanted July 23 by L. G. Carpenter, State Engineer, for the construction of a wagon bridge 105 ft. long and 14 ft. wide, with either stone, concrete or tabular abutments, across White River in the County of Rio Blanco.

Duluth, Minn.—A bridge with a plate girder deck is proposed to be built over Lester River on Grand avenue, at a cost of about $10,500, to replace the present structure.

Fort Benton, Mont.—Bids are wanted by E. Frank Sayre, County Clerk of Chouteau County, July 22, for the construction of a combination bridge, to consist of two spans of 200 ft. each, and 160 ft. approaches and 18 ft. wide, across the Marias River.

Fort Worth, Tex.—The city and the Fort Worth & Rosen Heights Street Railway Co. may jointly build a wire bridge over the Trinity River.

Glasgow, Mont.—Bids are wanted August 8, by R. J. Crossett, County Clerk, for building a bridge over Frenchman Creek in Valley County.

Glen Allen, Ont.—A new steel bridge with span of 155 ft. will be built over the Conestoga River in the township of Peel, to cost, with concrete abutments, $5,000.

Harrisburg, Pa.—Contracts for building State bridges, involving an expenditure of nearly $400,000, were awarded July 12 by the State Board of Public Buildings and Grounds as follows: Penn Bridge Company, of Beaver Falls, for bridges at Farnham, Wayne County, $12,221; Sharpsville, Mercer County, $23,680; Marovia, Lawrence County, $62,875; Goodmand, Wayne County, $6,295; Blakely, Lackawanna, $11,999, and Acid Factory, Wayne County, $5,122. The King Bridge Company, of Cleveland, Ohio, the bridge at Danville, at $134,900, and the Pennsylvania Steel Company, the bridge at Ulster, Bradford, at $140,000. Other bidders were: Milliken Bros., New York City; Ellery Colby & Co., Owego, N. Y.; J. L. Burcher, Honesdale, Pa.; Canton (Ohio) Bridge Co.; C. H. Reimard, Bloomsburg, Pa.; Whalen Construction Co., Towanda, Pa.; Boston (Mass.) Bridge Co.'s Works; Groton Bridge Co., New York; National Bridge Co., New York; York (Pa.) Bridge Co.; John P. Cowing; Riverside Bridge Co., Wheeling W. Va.; Peter Keefer, Sunbury, Pa.; Lewis F. Shoemaker & Co., Philadelphia; McClintock-Marshall Construction Co., Pittsburg; H. M. Stebbins, Wellsboro, Pa.; Berlin Construction Co.; Guerber Engineering Co., Bethlehem, Pa.; South Pittsburg (Pa.) Iron Works; Jacob B. Weidelick, Allentown, Pa.; Wm. McIntyre & Sons, Sharon, Pa.; Nelson & Buchanan, Chambersburg, Pa.; Wilson & Kipp, Towanda, Pa.; William Gulick & Co., Phœnixville, Pa.; Eyre Construction Co., Philadelphia, and Horn & Neff, Slatington, Pa. Under the act of 1895 36 bridges have been built in various parts of the State, aggregating an expenditure of $1,329,889.

Kent, Texas.—The Texas & Pacific 200-ft. double-span bridge and several smaller bridges were carried away by recent floods.

Newtown, Pa.—The Philadelphia, Newtown & New York Railroad Co. (Philadelphia & Reading) has given a contract to the Phœnix Bridge Co. to build a steel bridge over Neshaminy Creek to replace the structure recently destroyed by fire.

Owen Sound, Ont.—A committee of the County Council has recommended that a new steel bridge be built on the town line between Holland and Sydenham. Engineer McDowall will report as to the cost of building bridges at Strathavon and the Big Head River on the town line between St. Vincent and Sydenham.

Pittsburg, Pa.—It is said that bids will be asked next month for building a bridge 700 ft. long and 125 ft. high, to cost about $150,000, at Wilmot street.

Richmond, Va.—Plans for the proposed concrete bridge to be built on the site of the present Mayor Bridge, over the James River call for a bridge 32 ft. wide, with 26-ft. roadway and a 6-ft. sidewalk. The whole structure to be of concrete, paved with granite blocks. The Richmond end consists of seven spans 550.47 ft. long; the Manchester end of eleven spans 847.25 ft. long, making the total length of the bridge 1,397.72 ft. The distance across the island is about 350 ft.; this to be paved in same manner as the bridge. Richmond and Manchester will jointly pay for the work, which is to cost about $250,000.

Sandwich, Ont.—Four new steel bridges will be built by the County Council.

Taloga, Okla. Ter.—A contract for building the bridge over South Canadian River was awarded to the Alexander Bridge Company, of Kansas City, Mo., for $18,999. There were seven other bids, ranging up to $20,000. The river measures 1,282 ft. across at the point where the bridge will be located.

Titusville, Pa.—Bids are wanted July 18 by the Common Council for furnishing all materials and building a bridge at Bloss street over Trout Run. W. M. Dame is City Clerk.

### Other Structures.

Butte, Mont.—The Great Northern, it is reported, will build a passenger station during the summer; or will jointly build a union passenger station with the other roads.

Cleburne, Texas.—Work has begun on the big shops of the Trinity and Brazos Valley Railroad at this place. The shops of the Gulf, Colorado & Santa Fe, recently destroyed by fire at a loss of $160,000, will be replaced with stone structures.

Jersey City, N. J.—It is reported that the Erie and the Delaware, Lackawanna & Western will establish ferryhouses at Thirteenth street, near the tunnel through which trolley cars will be run between Jersey City and Manhattan.

Mobile, Ala.—The Railroad Commission on July 5 approved plans of the Southern Railway for a new union station, to cost $150,000, on ground that cost $100,000, to be used by all the railroads entering Mobile. The work of construction is to begin at once.

New Orleans, La.—The New Orleans Terminal Company has been granted building permits by the City Engineer's office for the construction of a roundhouse, sand-drying plant, four one-story brick buildings, elevator, water tanks and other structures, to cost about $190,000. These permits do not include the station to be built at Canal and Basin street.

Omaha, Neb.—Plans for the proposed Chicago-Great Western freight house in Omaha have been completed and bids for the construction have been received and are being considered. The depot will be 65 ft. x 400 ft.

Phillipsburg, N. J.—The Delaware, Lackawanna & Western is about to commence work on its new combined freight house and passenger station between Main and Brainerd streets.

ROSWELL, N. MEX.—The Pecos Valley & Northeastern will at once build a brick and stone passenger station, two stories high.

TORONTO, ONT.—The Canadian Pacific and Grand Trunk offer to jointly build a union passenger station provided the city will lease the companies some land which is required for a site for $15,000 a year, and also agree to fix the station assessment on a million-dollar station at $300,000.

## RAILROAD CONSTRUCTION.

### New Incorporations, Surveys, Etc.

BAYFIELD, LAKE SHORE & WESTERN.—According to newspaper reports a company has been formed to build a railroad from Bayfield, Wis., west to Superior, 65 miles. Work will be begun at once. Robert R. Dunn, of St. Paul, Minn., is said to be interested.

BEAUMONT, SOUR LAKE & WESTERN.—This company has filed an amendment to its charter, changing the name from the Beaumont, Sour Lake and Port Arthur to the above title. The amendment also provides for an extension to Houston. According to the new change the company will build from Beaumont to Port Arthur and then to Batson and Houston. G. W. Meeker, Beaumont, Texas, is President. (See Construction Supplement.)

CANADIAN PACIFIC.—An officer writes that the proposed line between Toronto and Sudbury will pass through Romford, Parry Sound, Balla and Barrie to a connection with the Owen Branch at Woodbridge. Grading is now in progress by the contractors, Foley Bros., Larson & Co., of St. Paul. On the northern end there is much rock cutting, while the Southern end runs through an agricultural country. The maximum grade will be 0.3 per cent. and the maximum curvature 6 degrees. (June 3, p. 430.)

A contract has been let to J. G. Hargrave & Co. to build a new line on the Yorkton branch out of Harrowby, Man. The change is made to get a better grade and also to avoid several curves on the present line.

CHERRY TREE & DIXONVILLE (PENNSYLVANIA).—This company has let a contract to D. F. Keenan, of Philadelphia, for building a six-mile branch line from Diamondville, Pa., to a point on Dixon Run. (May 13, p. 375.)

CHICAGO, ROCK ISLAND & PACIFIC.—According to press reports, work will be begun at once on the extension of the Searcy & Des Arc branch between De Vall's Bluff and Des Arc, 16 miles. The extension will run from Des Arc to mile post 88, on the Rock Island main line, which is about two miles west of De Vall's Bluff and five miles east of Hazen. Craney Bros., Hoopestown, Ill., are the contractors.

COLORADO & NORTHWESTERN.—This company, which recently succeeded, by order of court, to the property of the original company of the same name, is building the Eldora extension from Boulder, a distance of 19 miles. Grading for the first seven miles has been completed, bridges have been erected and tracklaying is in progress. Col. S. B. Dick is President and R. S. Sumner, Boulder, Colo., is Chief Engineer. (June 24, p. 15.)

DEPUE & NORTHERN.—This company has been incorporated in Illinois to build from Depue northeast to Seatonville, both in Bureau County, 6 miles. William B. McIlvaine, Lakeside, Ill.; Houston C. Adcock, Western Springs, Ill., and others are incorporators.

KANKAKEE & MOLINE.—This company has been incorporated in Illinois to build from Kankakee through the Counties of Kankakee, Grundy, La Salle, Henry and Rock Island to Rock Island City. The authorized capital is $100,000. The incorporators and first board of directors include William R. Burleigh, La Grange, Ill.; Gideon S. Thompson, Berwyn, Ill., and others.

LARAMIE, HAHN'S PEAK & PACIFIC.—Press reports say that a sufficient number of bonds have been placed to furnish capital to complete the line to Centennial and eventually to Grand Encampment. The line is graded to Centennial, 30 miles west of Laramie, and seven miles of track have been laid. Work is to be begun at once. F. A. Miller, Laramie, Wyo., is President. (See Construction Supplement.)

LITTLE BAY & HAMPTON.—Charter has been granted in Arkansas for a line from Little Bay to Gordon, in Calhoun County, 10 miles. H. M. McLachlin, L. N. Smyth and others, of Little Bay, Ark., are incorporators.

LOWVILLE & BEAVER RIVER.—Bids have been received for building this proposed line from Lowville, N. Y., to Croghan, 10 miles. It is stated that the contract for grading will be let at once. F. S. Easton, Lowville, N. Y., is interested. (See Construction Supplement.)

MENA & BLACK SPRINGS.—See Mena, Hot Springs and Eastern below.

MENA, HOT SPRINGS & EASTERN.—An amendment has been filed to the charter providing for building from Black Springs to Hot Springs, 50 miles. The line, as originally proposed, was to extend from Mena to Black Springs, 35 miles. The amendment also provided for an increase of the capital stock from $500,000 to $2,500,000, and for the change of the company's name from the Mena & Black Springs to the above title. Work is now in progress by the Arkansas Exploration Co. W. A. Carroll, Mena, Ark., is President.

MEXICAN ROADS.—The Compania de los Ferrocarriles Urbano y Agricola of Oaxaca, Mexico, has secured a concession from the Mexican Government to build and operate a narrow gage railroad in the State of Oaxaca from Santa Anita, near the city of San Juan, Chapultepec, to Ayoguezco, in the district of Villa Alvarez.

Arrangements have been made for building an extension of the Torres & Prieta from Minas Prietas, in the State of Sonora, southeast to a point on the Yaqui River. The proposed extension will tap the San Marcial coal fields, which are owned by the Southern Pacific.

The Compania Minera, of Saltillo, will build a railroad from its mines, near Mazapil, in the State of Zacatecas, to Bonanza, on the Coahuila & Pacific.

It is said that the Rothschild syndicate, which owns the Inguaran copper mines in the State of Michoacan has completed arrangements for building a railroad from the mines to a connection with the National Railroad of Mexico, near Patzcuaro.

NATIONAL OF MEXICO.—Press reports say that this company will build a branch line 11 miles long from a point on its Matamoros branch (now building) to the Cerralvo mining district. The Matamoros line will be completed and placed in operation about September 1.

OAKDALE WESTERN.—Work is reported in progress on this proposed railroad between Riverbank, Cal., and Oakdale, six miles. The line will eventually be extended to Modesto. It will connect the Atchison, Topeka & Santa Fe with the Sierra Railway. According to the terms of the contract, grading must be finished by August 20. W. F. Beard & Co. are the contractors.

OAK GROVE & GEORGETOWN.—This company has been organized in Alabama to build from Oak Grove, Ala., northwest through Georgetown to Leakesville, Miss., 30 miles. M. L. Davis, Oak Grove, and J. W. Whiting, Mobile, Ala., are among the promoters.

PHILADELPHIA & READING.—A contract has been let to Ryan & Kelly, of Philadelphia, for straightening the main line from a point about seven-eighths of a mile above Swedeland to a point about one mile below that village. Work is to be begun at once and completed before fall. This improvement will do away with a sharp curve passing through the Heckscher furnaces.

PHILADELPHIA TERMINAL. — Application has been made for a charter to build a 28-mile railroad in Chester and Delaware counties. One line will run from the western terminus of the Market Street Elevated Railroad Company, Philadelphia, to Willistown, Chester County, and the other from the same terminus to Eddystone, Delaware County. The capital is $280,000, and the President is Clarence Wolf, Philadelphia.

PORTLAND, SALEM & WEST SIDE (ELECTRIC).—Articles of incorporation have been filed by this company in Oregon. The road will be 45 miles long and will be operated by electricity. The names of incorporators are not stated.

RIO GRANDE & NUECES VALLEY.—Ward & Lee, of Palestine, Texas, have been awarded a contract to build the first 20 miles of this road, which is to extend from Cotulla to Carrizo Springs, Texas, 40 miles. Connection will be made with the International & Great Northern at Cotulla. W. H. Davis, Carrizo Springs, Texas, is interested. (April 29, p. 336.)

SOUTHERN SONORA & ALAMOS.—Press reports state that work is about to be commenced on a line which will run from Alamos, in the State of Sonora, to some point on the Gulf Coast, probably terminating near Santa Cruz. Laselle and Jennings are reported to have a contract to build this new line, which will be 94 miles long. The new project is said to be backed by a syndicate of New York capitalists.

WISCONSIN & MICHIGAN.—Work has been begun on the extension of this road from Nathan, Mich., to Headquarters, eight miles, where a connection will be made with the Holmes logging road, recently acquired by the W. & M. It is expected that the extension will be completed by September 15. The logging road will be converted into a permanent line and the company expects to handle a large amount of timber over the new line. There will be one steel bridge over the Menominee River. B. C. Gowan is Chief Engineer.

## RAILROAD CORPORATION NEWS.

BALTIMORE & OHIO.—This company has sold $1,000,000 of 50-year 4 per cent. bonds. The original reserve under this clause of the mortgage was $27,000,000, which could be issued at $1,500,000 per annum up to the end of the fiscal year 1903, and $1,000,000 per annum after that. The present issue of $1,000,000 is the first year's allowance under the reduced rate. The amount already issued is now $7,000,000. There is a reserve of $20,000,000 still in this fund, issuable at $1,000,000 or the next 20 years. The proceeds from the sale will be used for additions and betterments.

CHICAGO, ROCK ISLAND & PACIFIC.—L. M. Allen, general passenger agent, is reported as saying that the new line between St. Louis and Kansas City will be opened to traffic about August 1. All of the heavy work has been completed and the connections in the vicinity of Kansas City only remain to be finished.

CINCINNATI, HAMILTON & DAYTON.—The United States Mortgage & Trust Company, which acted as banker in the negotiations for the merger of the Cincinnati, Hamilton & Dayton, the Pere Marquette and the Chicago, Cincinnati & Louisville, has authorized the following statement: "Financial interests have acquired control of the Cincinnati, Hamilton & Dayton, the Pere Marquette, and the Chicago, Cincinnati & Louisville. Traffic rights have been secured over the tracks of the Toledo Terminal & Railway Co., which is the principal physical connection between the properties. The Pere Marquette will on the 18th inst. enter upon its traffic agreement, which will give it a through line from Chicago to Buffalo. Through the merger the C., H. & D. will get a through line into Buffalo from Cincinnati. The plans for the merger have not yet been definitely determined, but it is expected that when

it is completed it will be with a mortgage obligation of not exceeding $25,000 a mile, and with a capital stock, preferred and common, outstanding of not more than $11,000 per mile. The earnings of the three roads under separate organization last year approximated $21,000,000.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company has sold $600,000 5 per cent. car trust notes, payable in four years at the rate of $13,000 a month. The proceeds from the sale will be used for new equipment and for the improvements on the St. Louis division. The majority of the notes were taken by the American Car & Foundry Co. in payment for equipment, and the balance went to the Union Trust Co. of St. Louis. The average maturity of the notes is two years.

DETROIT SOUTHERN.—The following announcement has been made by officials of the Detroit Southern, regarding the appointment of a receiver. The receivership is a friendly one, the management having decided that it is best to put the road under the protection of the court, so as to be enabled to raise the capital immediately and to put the property into shape as promptly as possible, in order to develop its earning capacity. The refunding plan has never been declared operative, and will most likely be abandoned. The largest interests have no fixed plan for the reorganization, and there is not likely to be any plan until some time next fall. (July 8, p. 30.)

A committee has been appointed, consisting of O. T. Baunard, S. C. Borg, P. J. Goodhart, G. B. Moffat and J. H. Oliphant, to protect the interests of the bondholders. Holders of the first mortgage bonds are requested to deposit their bonds, with June, 1904, coupons, or funded coupon bond attached, with the New York Security & Trust Co. on or before the first day of August, 1904. Negotiable temporary receipts will be issued in exchange for all bonds deposited.

GAINESVILLE, JEFFERSON & SOUTHERN.—This road was sold at auction at Gainesville on July 5. The first section, running from Gainesville to Jefferson, with a branch from Belmont to Monroe, 55 miles, was sold to G. W. Baldwin, of Savannah and associates for $165,000. The remaining portion of the road, from Monroe to Social Circle, 10 miles, was bought by Jacob Phinizy, of Augusta, for $30,000.

GREAT NORTHERN RAILWAY OF CANADA.—The *Commercial and Financial Chronicle* says: Plans are being matured for the merger of the Great Northern of Canada, the Chateauguay & Northern, the Montfort & Gatineau and the Quebec, New Brunswick & Nova Scotia. A new company will be formed to take over the properties and a mortgage issued for about $8,000,000, which will cover the present road extensions, terminals and equipment. Canadian Northern interests will take $4,000,000 of the new 4 per cent. bonds at 85, which will provide the cash for the proposed extensions, payment of floating debt, equipment notes and liens on terminals, and leave some $600,000 of the bonds in the treasury. The plan contemplates the payment of the interest defaulted July 1 on the Great Northern of Canada bonds and the exchange of these bonds for those of the new issue, making the latter a first mortgage on the combined system, its terminals, equipment and all property. The new company will be controlled by the Canadian Northern interests and will be operated in close connection with that system.

GULF & SHIP ISLAND.—Fisk & Robinson announce that the syndicate in the bonds has been closed with a satisfactory profit to the underwriters.

HUNTINGDON & BROAD TOP MOUNTAIN.—At a special meeting of the directors on July 8 the semi-annual dividend on the common stock was passed and the semi-annual rate on the preferred stock was reduced from 3½ to 2½ per cent. The company operates a line from Huntingdon, Pa., to Bedford, 53 miles. C. M. Gage is General Manager.

INTERCOLONIAL.—The recent report shows a heavy increase in operating expenses and large decrease in net earnings. For the first 10 months of 1903 (fiscal year) gross earnings were $5,292,639 and for the same period of 1904, $5,287,521, a decrease of $5,118. The expenses for the first 11 months of 1903 were $5,288,765 and in 1904 were $5,835,294, an increase of $546,530, leaving a deficit of $547,772 for the last 10 months.

MISSISSIPPI CENTRAL.—A mortgage has been made with the Colonial Trust Co. of New York to secure an issue not exceeding $5,000,000 of first mortgage 5 per cent. 30-year gold bonds. These bonds, which are to be issued as the company sees fit for future extensions and improvements, are subject to call after May 1, 1905, at 105 and interest. The road is now in operation from Hattiesburg to Silver Creek, Miss., 55 miles. Extensions are projected from Hattiesburg to Scranton, 80 miles, and from Silver Creek to Natchez, 115 miles. This road was formerly known as the Pearl & Leaf River. F. L. Peck is President.

MUSCATINE NORTH & SOUTH.—The foreclosure sale of this railroad, which runs from Muscatine, Iowa, to Elrick Junction, 29 miles, has been postponed until September 6. Charles Howard, Muscatine, is receiver.

OZARK & CHEROKEE CENTRAL.—Farson, Leach & Co., New York, are offering for sale $100,000 first mortgage 5 per cent. gold bonds of this company. These bonds are guaranteed, principal and interest, by the St. Louis & San Francisco and mature October 1, 1913. They are a first mortgage on 143 miles of road in Indian and Oklahoma territories.

PERE MARQUETTE.—See Cincinnati, Hamilton & Dayton above.

PETALUMA & SANTA ROSA.—This company has filed a chattel mortgage on its property for $1,000,000. Bonds will be issued running for 20 years and bearing 5 per cent. interest. The proceeds will be used to pay for the line which the company proposes to build from Petaluma, Cal., to Sebastopol, 16 miles.

SEABOARD AIR LINE.—Regarding the reported new financing of this company Hambleton & Co., in their weekly circular, say: Recent reports have had it that there was to be an early announcement of some very decided change in the financial policy of the Seaboard Railway system, embracing, as it was stated, the formation of a holding company, together with the creation of a new loan and the giving up of a certain amount of stock by the present holders, but if such a plan was seriously considered it appears to have been abandoned. For the present at least the company is not in need of funds and can get along with the capital already supplied, together with its income over and above fixed charges.

SOUTHERN PACIFIC.—The stockholders will hold a special meeting July 20 at Beechmont, Ky., a suburb of Louisville, to ratify the proposition to create $100,000,000 preferred stock. According to the resolution to be offered to the stockholders for ratification, the preferred stock shall be entitled to dividends in each fiscal year at such rate, not exceeding 7 per cent. per annum, as shall be declared by the Board of Directors, before any dividend shall be declared on the common stock. Resolutions adopted by the Board of Directors outlining the plan for the new preferred stock provide that in case of the dissolution of the company, voluntarily or otherwise, the preferred stock shall be paid at par before the common stock shall have any equity in the property.

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## EDITORIAL ANNOUNCEMENTS:

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*CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.*

*ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

FRIDAY, JULY 15, 1904.

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